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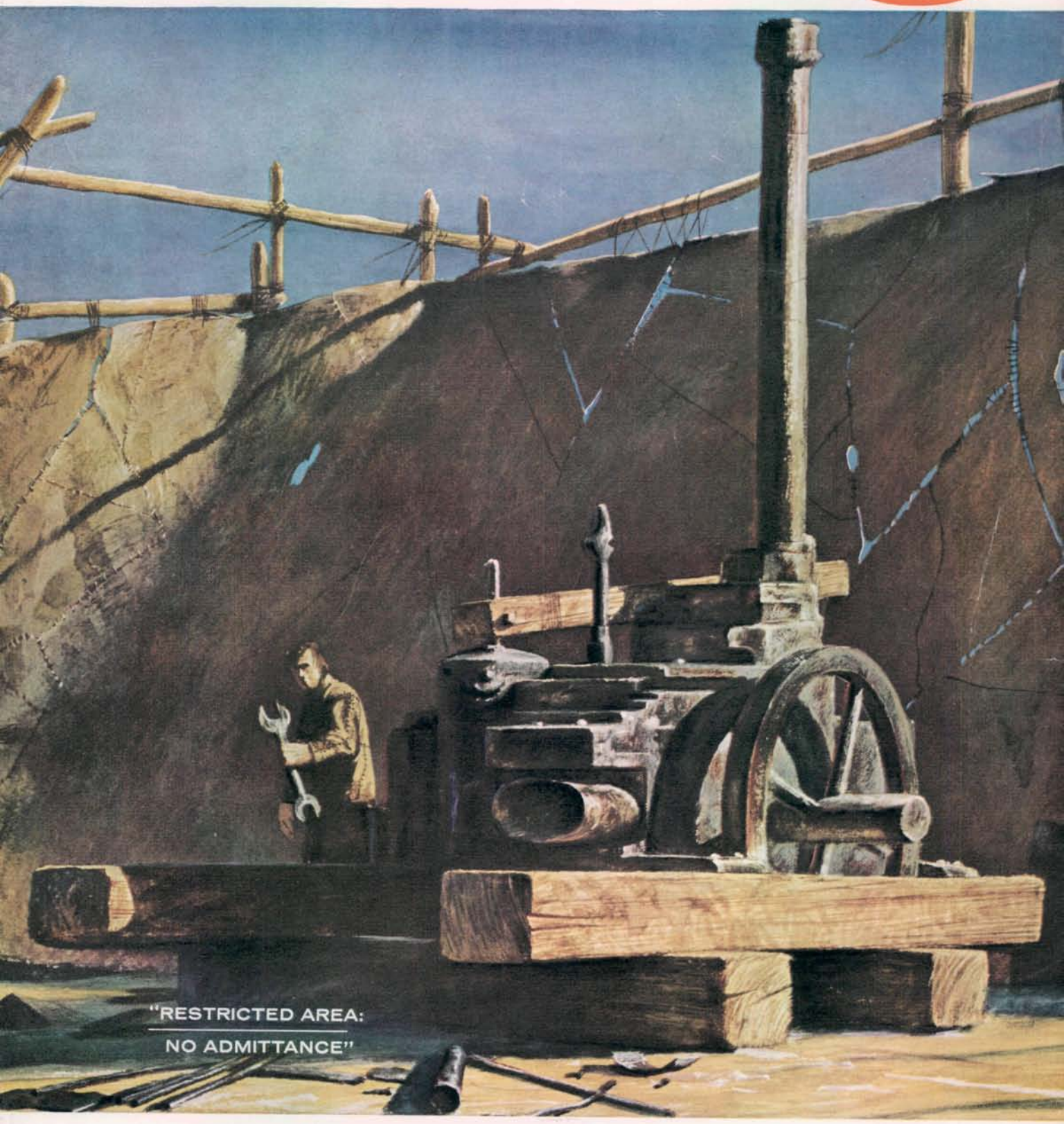

THE ETHICAL ENGINEER | BY HARRY HARRISON

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"To the eyes of the man of imagination,
Nature is imagination itself."

William Blake

The creation of imaginative, fresh patterns through studying the nature and behavior of matter is the heart of our research effort.

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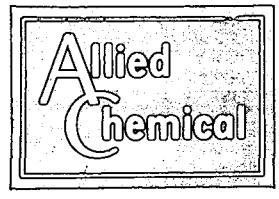

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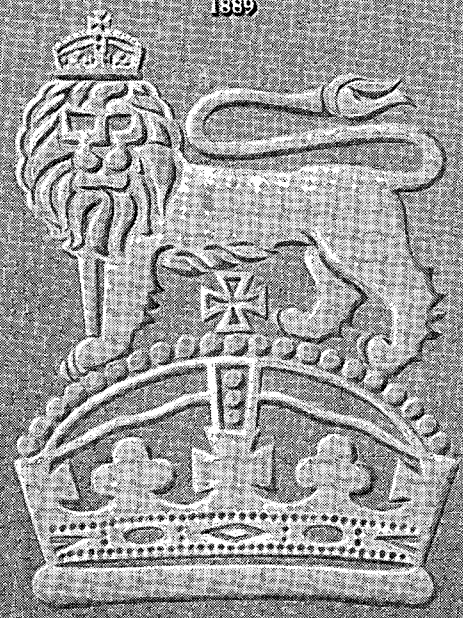

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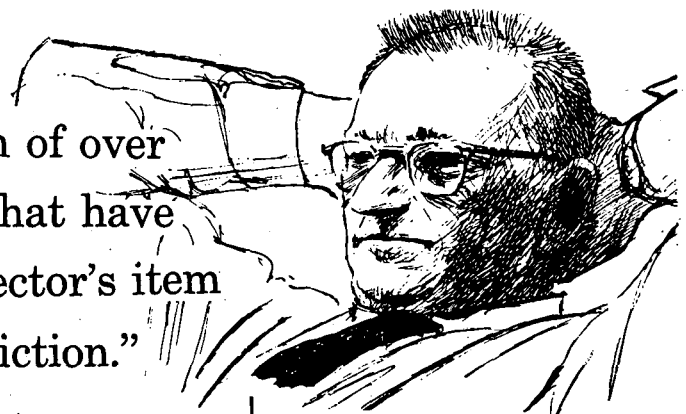

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by John W. Campbell, Editor, ANALOG Magazine

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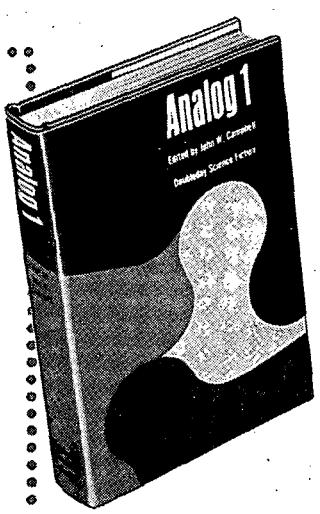

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By T. R. Fehrenbach

Time Machine #X-4-A hurled Ord back to 1836 — to Jim Bowie, Davy Crockett, and a handful of others in an old mission called The Alamo. But the Time Machine made one small slip. The time and place and people were right. But the *results* which occurred are not to be found in any history book!

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Stellar Scouts Connely and MacIntyre didn't have to think. The new, smug-looking equipment of the 260 thought for them. But Connely didn't completely trust the equipment. It couldn't "think" them out of the almost certain destruction ahead. He had a hunch. It payed off — *at MacIntyre's expense!*

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By Winston P. Sanders

In trying to cross the Asteroid Belt, Bull discovered that the entire space ship was being eaten up by Space Barnacles! In a matter of hours, it would be completely encrusted — and Bull's entire crew *doomed!*

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Commander William Powers had seen it happen before. And now it must happen again — the absolute obliteration of the inhabitants of Planet #27! Thereafter, the planet would be inhabited by Desmodus, the Vampire Bat!

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Vol. LXXI, No. 5 | JULY 1963

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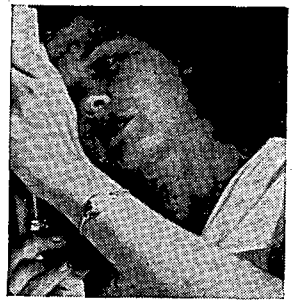

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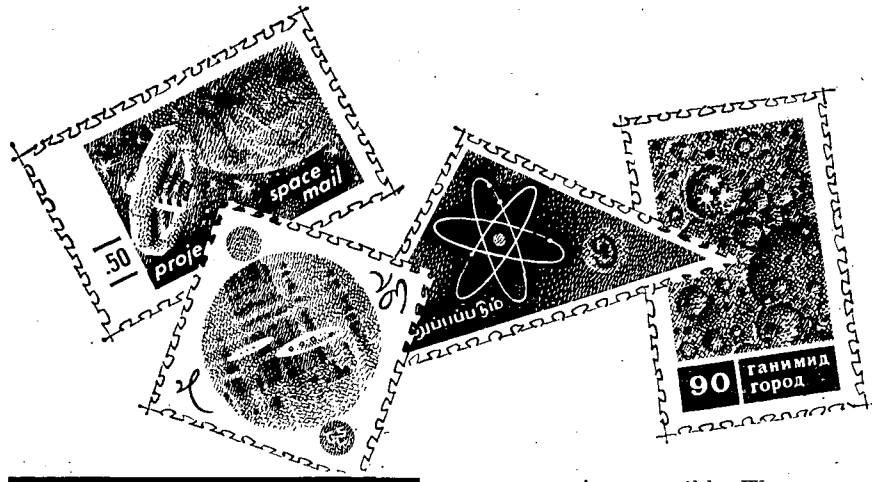

BRASS TACKS

Dear Mr. Campbell:

For the first time in my life I am writing a "letter to the Editor"—though I have composed many in my mind—your editorial "The Lesson of Thalidomide" in the January issue of *Analog*, was a most surprisingly intelligent appraisal of the facts. In being surprised, I am not casting aspersions on you or on your magazine, but simply in having read many articles in the popular press, the trend is to sentimentalize and get on the current bandwagon without appreciation or respect for the true facts. May I congratulate you.

As a microbiologist employed by an ethical pharmaceutical firm—not Merrill—I feel very strongly about the role played by such firms in the advances made in the medical fields. I am sure, when the thalidomide news broke, there wasn't one member of any ethical concern in the country who did not feel "it could happen to anybody—thank God it wasn't us." Contrary to public opinion, the people who are employed by the pharmaceutical industry are not conscienceless, money-hungry parasites on the poor defenseless sick. Certainly, we work for industry because we earn more than we would in either universities or the government, but on the other hand, we have to be good. We have to earn our paycheck. There is no civil service roster or academic tenure for us. If we cannot produce, we're out. But we are not irresponsible. We want to put out a product, of course. The company wants a product. The stockholders want a product. But a product that will do, to the best of our knowledge, what we say it will do. And that will be as safe as our exhaustive testing says it is. The most traumatic moment in my life was when, as senior scientist in charge of safety-testing of a vaccine that was to go into clinical trial on children, I was brought a form and a bottle of indelible ink to sign my name to a form that said this was safe. To the best of my knowledge, to the best of my ability it was safe. I would have permitted its injection into my own child. But suppose I had made a mistake? Suppose I had overlooked some one little thing? I signed, because I believed I was responsible, and because I believed that my company was responsible. Then I sweated out the time period when something untoward might have shown up. It didn't. I was lucky. But it could have, and I firmly believe that neither I nor my company would have been to blame. A very few children might have had encephalitis if I had been wrong. If I was right, thousands of children would not have had encephalitis. This is a calculated risk, and to my mind, one worth taking.

To those of us in the industry who have heard the "inside" thalidomide story it is a comedy of errors. It was, as you said, not kept off the market in this country because of sound scientific judgment, but because of a whim, and because the person re-

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sponsible just didn't get around to it. The company, believing it to be good, tried to hurry it along—a natural and common effort—and ran into just plain human—or female—stubborness. "Nobody is going to push me around." So now the press has a heroine and a villain, and everybody's happy. Public opinion is aroused. But what are all these new laws and regulations going to do to research?

We are all wondering. Is it going to be worth-while for companies to keep throwing millions of dollars into research, with a stumbling block placed in their path on every point? Are the advances in science going to continue? Will we continue to hunt for an understanding of, and care for cancer, or will it just not be worth the cost in time, money and battle with red tape? When the average man is sick, really sick, no cost seems too great to get well, but once he is well, it seems that he spent an unnecessray amount of money getting that way. It is well recognized in the industry that a lawsuit brought against a pharmaceutical company had better be settled out of court. Right or wrong, a big company is always felt by a jury well able to afford to pay the poor private citizen, even if the citizen doesn't really deserve payment.

I am going to see that your editorial is well circulated among our public-relations people. I think it deserves wide coverage. While we try to stand up for ourselves, in the face of public opinion and the popular band-riding press, it is all too rare that a lay publication comes to the fore with an intelligent, factual expression of the facts!

M. W. H.

■ *Name withheld as requested—save that, in this particular case, it is relevant that this writer is a woman.*

The lesson of thalidomide continues and expands—for it has since been learned that thalidomide may be an effective cancer therapeutic agent! Thalidomide's tragic side-effect damaged the growth of human

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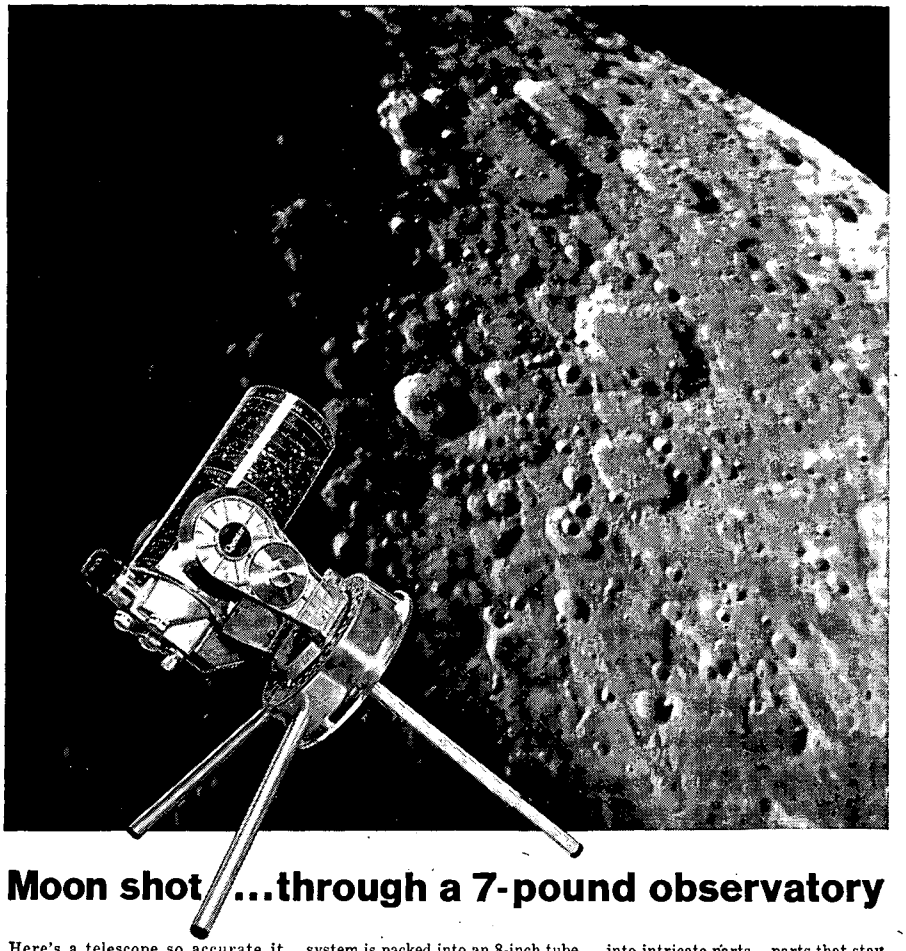

Moon shot...through a 7-pound observatory

Here's a telescope so accurate it takes moon photos which compare favorably with those taken by large observatory instruments.

It traces rockets back from space ... works perfectly in steaming jungles ... performs equally as well at −86°F in the stratosphere ... even helps safely study high-temperature industrial processes.

To obtain such performance, the designers of this telescope needed materials that could withstand the shocks of hard usage as well as temperature extremes and corrosion. And these materials had to be readily fabricable into highly intricate parts, since the telescope's powerful optical system is packed into an 8-inch tube.

Nickel was the answer for many parts ... in the form of Nickel Stainless Steel for such components as tubes in the focusing mechanism; baffle tube, axles, drive disks, shafts, levers, declination circle, and all fasteners.

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Moreover, Nickel in stainless steel helps it to be more easily fabricated into intricate parts — parts that stay bright and untarnished for years — parts that clean with a wipe.

Excepting this final paragraph, this whole advertisement was prepared by the International Nickel Company, Inc., 67 Wall St., New York 5, N.Y. They ran this page in the February 10th issue of Business Week; circulation 400,000. Wasn't that nice of them? We think so, and because we think it splendid for our product, the versatile Questar, we repeat it here. Questars cost $995. May we send our 32-page booklet?

QUESTAR

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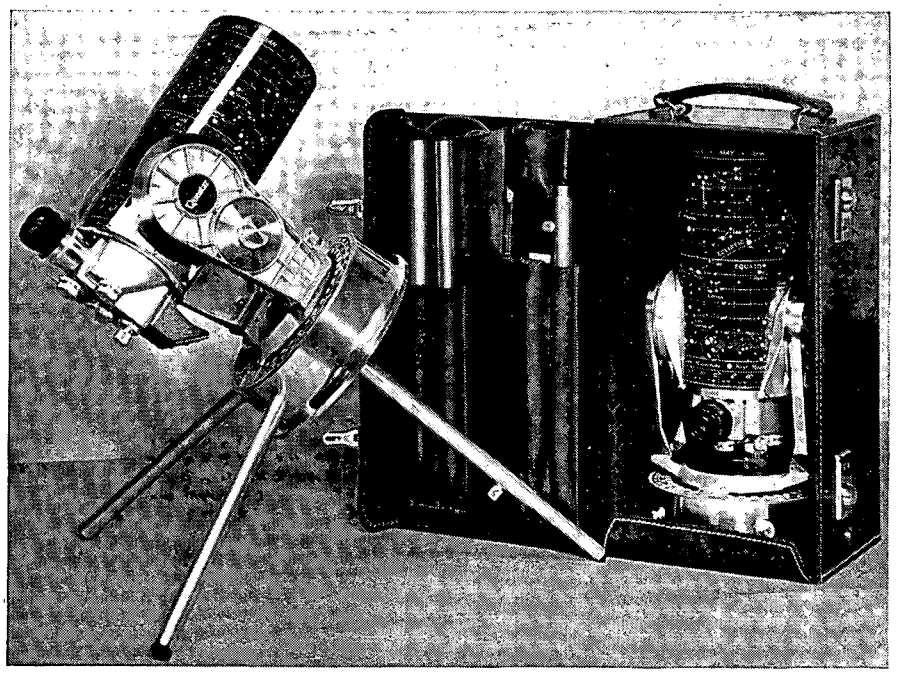

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WHERE DID EVERYBODY GO?

AN EDITORIAL BY JOHN W. CAMPBELL

The data that Mariner II signaled back as it passed Venus last December has been released only gradually—and turns out to be largely confirmation of the completely upsetting fact that Venus has a surface temperature of some 600° to 800°F. It's upsetting, because it shatters nearly all our conceptions of the nature of the planets—and of the probabilities of life on other worlds.

Combined with the recent determination of the nature of Mars' reddish color, and the nature of those polar caps, the Solar System has suddenly become a mighty lonely-looking place. Mars' reddish color, it now appears, is due to the familiar red-brown nitric oxide gas in its thin atmosphere—and the polar caps are solid masses of the white solid form of nitric oxide. It's unnecessary to look for water on Mars, now; if there is any free liquid, the brooks and lakes would be what is now familiarly designated as RFNA—fine for rocket fuels, but Red Fuming Nitric Acid isn't for drinking.

But science fiction has lost more than its Venus colony—at 800°F.? . . .!—and its Mars colony. We just lost the chance for intelligent aliens circling other stars. Because the facts we've now learned force a revision of our most basic conception of What Planets Are Like.

We've been deluded by an especially tricky type of reasoning-trap, that is usually almost impossible to detect until after you've been suckered by it. In this case, it goes "I know what planets are like; I live on one." The stinker in that happens to be that our knowledge relates to a so-far-as-we-know absolutely unique planet, and one that our knowledge to date indicates must be at least *(Continued on page 92)*

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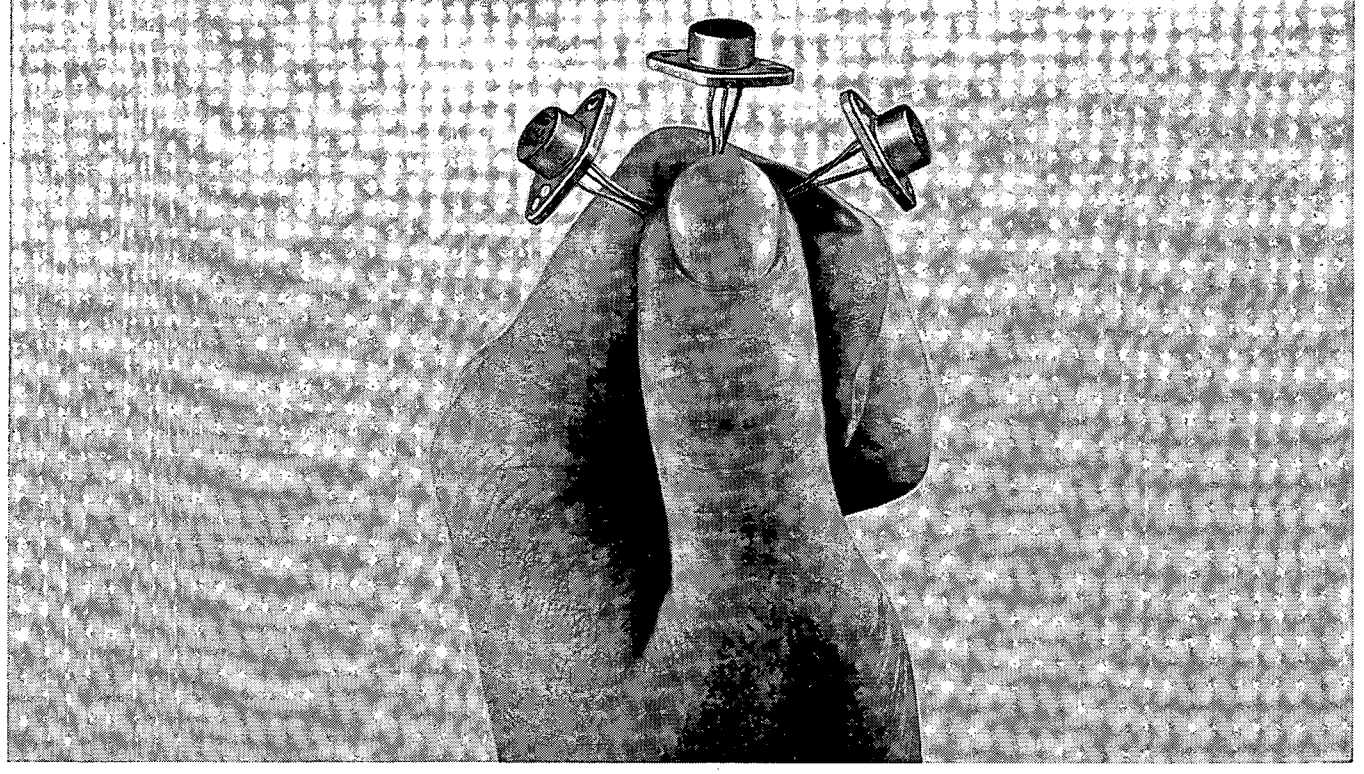
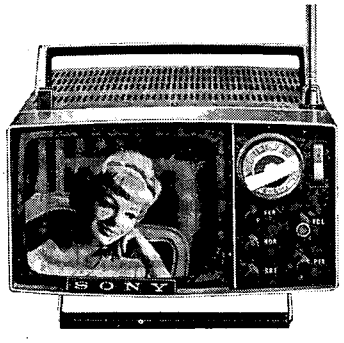
even the transistors are revolutionary!



SONY MICRO-TV—THE TELEVISION OF THE FUTURE



Even the transistors in the remarkable SONY Micro-TV are revolutionary. For the first time in a home set, the new epitaxial power transistor is used, to permit a smaller and much more efficient power supply. Heretofore, epitaxials were used only in complex industrial and military systems. Only 8 lbs., Micro-TV operates on its own rechargeable battery, 12v auto/boat battery and AC. Viewed from arm's length, with no distracting scanning lines, the picture surpasses anything seen before. SONY 5-303W list **$189.95.** Rechargeable battery, carrying case, auto accessory kit, extra.

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The big fuel feud

Conclusion. The trouble with the great liquid-vs.-solid fuel dispute is that neither type is really satisfactory, and each can, therefore, damn the other's unhandiness, expense, low energy output . . . and selecting one over the other becomes a matter of engineering judgment. Liquids leak—solids deteriorate . . .

BY HARRY B. PORTER

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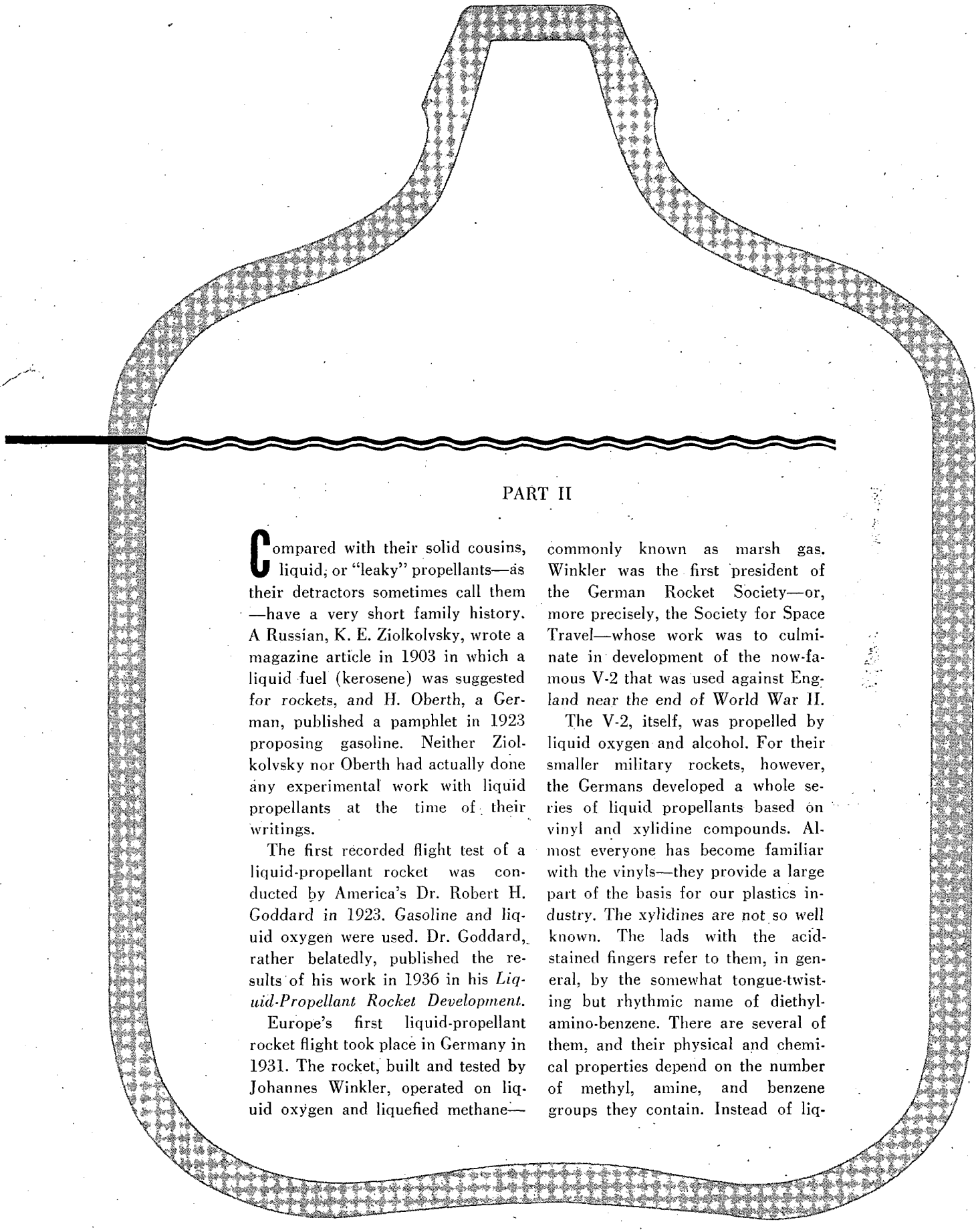

PART II

Compared with their solid cousins, liquid, or "leaky" propellants—as their detractors sometimes call them—have a very short family history. A Russian, K. E. Ziolkolvsky, wrote a magazine article in 1903 in which a liquid fuel (kerosene) was suggested for rockets, and H. Oberth, a German, published a pamphlet in 1923 proposing gasoline. Neither Ziolkolvsky nor Oberth had actually done any experimental work with liquid propellants at the time of their writings.

The first recorded flight test of a liquid-propellant rocket was conducted by America's Dr. Robert H. Goddard in 1923. Gasoline and liquid oxygen were used. Dr. Goddard, rather belatedly, published the results of his work in 1936 in his *Liquid-Propellant Rocket Development.*

Europe's first liquid-propellant rocket flight took place in Germany in 1931. The rocket, built and tested by Johannes Winkler, operated on liquid oxygen and liquefied methane—commonly known as marsh gas. Winkler was the first president of the German Rocket Society—or, more precisely, the Society for Space Travel—whose work was to culminate in development of the now-famous V-2 that was used against England near the end of World War II.

The V-2, itself, was propelled by liquid oxygen and alcohol. For their smaller military rockets, however, the Germans developed a whole series of liquid propellants based on vinyl and xylidine compounds. Almost everyone has become familiar with the vinyls—they provide a large part of the basis for our plastics industry. The xylidines are not so well known. The lads with the acid-stained fingers refer to them, in general, by the somewhat tongue-twisting but rhythmic name of diethylamino-benzene. There are several of them, and their physical and chemical properties depend on the number of methyl, amine, and benzene groups they contain. Instead of liq-

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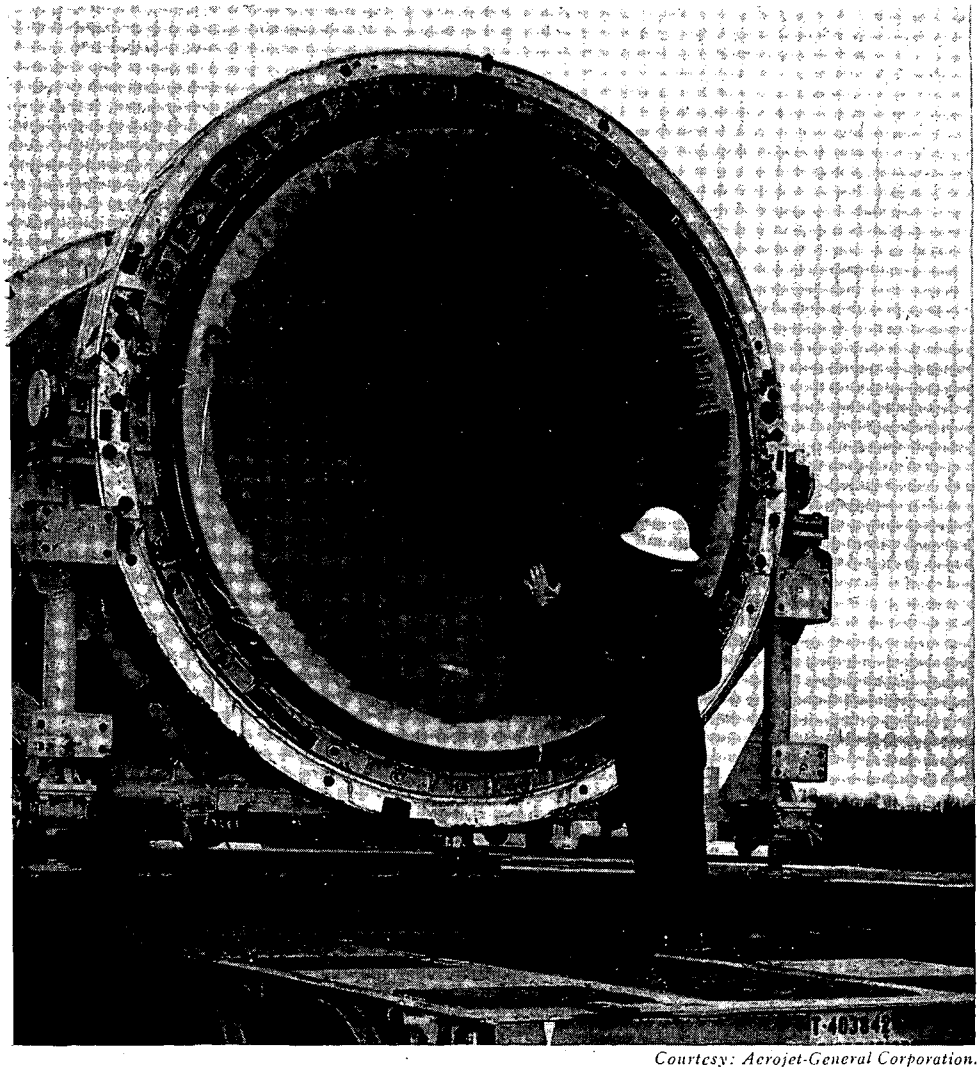

Courtesy: Aerojet-General Corporation.

uid oxygen, nitric acid was used as the oxidizer for the vinyl and xylidine fuels. Liquid oxygen would have worked but, for tactical reasons, it was necessary to be able to fire those particular rockets at a moment's notice and the necessity of keeping the liquefied gas at an extremely low temperature made its use impracticable.

Nitric acid, although not as efficient an oxidizer as LOX, has the great advantage of being storable at ordinary temperatures for long periods of time. About sixty-four per cent of the weight of nitric acid represents oxygen which is released in the combustion chamber. American scientists found that better performance could be obtained by dissolving somewhere around ten per cent, by weight, of nitrogen dioxide (NO_2) in the nitric acid. The resulting mixture is known as red-fuming nitric acid, or simply RFNA.

After World War II, American rocket science received a terrific shot in the arm when several hundred carloads of V-2 parts were shipped over from Germany to be assembled and tested at the White Sands Proving Ground in New Mexico. In fact, the Americans couldn't wait for the captured V-2's to arrive: they had already developed a rocket of their own—the WAC Corporal, and flight-tested it at White Sands seven months before the first V-2 was fired there.

The first WAC Corporal was propelled by gasoline and nitric acid. Later models, however, burned aniline —the same stuff from which aniline dyes are made. Aniline freezes at around 21° F, which is a matter of little moment on a warm summer day at sea level. In winter or at a high altitude, however, it is quite important. (It is always downright embarrassing to discover that one's liquid-fuel tanks are filled with solid propellant.) So furfural alcohol was mixed with the aniline to act as an antifreeze. The mixture consisted of about one part alcohol to four parts aniline, by weight.

Then came the Aerobee—a sort of little brother to the WAC Corporal—and the Viking, which was designed along the same lines as the V-2. These were followed by a rapid succession of bigger and better liquid-propellant rockets, each of which seemingly performed more spectacularly than its predecessors.

In view of the reatively short period of time involved, it may seem that the development of liquid-propellant rockets was fairly easy. There were a number of problems, however, that had to be solved before they could ever be more than interesting novelties. One of the more important problems was that of getting the fuel and oxidizer to the combustion chamber fast enough. The fuel and oxidizer must be kept apart until they are mixed in the combustion chamber, so two separate "delivery" systems are required.

For small rockets, the tanks containing the fuel and oxidizer may be pressurized—partially filled with an

Fig. 8: A segment of the 100-inch-diameter solid-propellant motor in Fig. 7 (last month). Note the circular perforation. The transparent plastic film cover is to protect the propellant from moisture. Segmented motors can be shipped as segments, then assembled at the launching site.

Fig. 9: Test firing of a 35-ton segmented solid-propellant booster. This motor produced a 100,000 pound thrust for 130 seconds— the longest firing duration achieved by any solid-propellant booster up to the time of the test (April 1962). A longer burning time makes it possible to reach orbital or interplanetary velocities with acceleration below the maximum that can be tolerated by the human body and delicate instruments.

Courtesy: United Technology Corporation.

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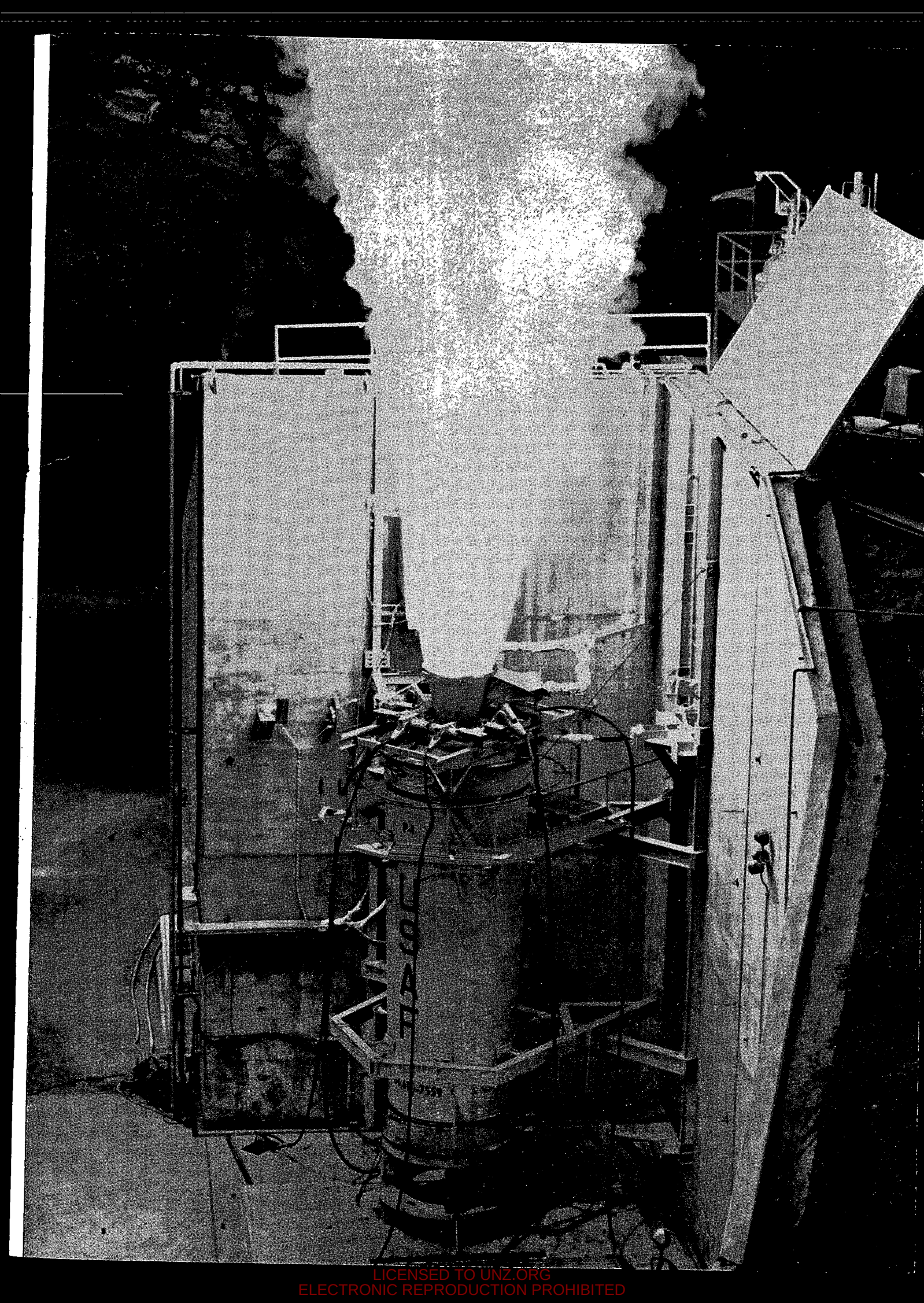

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inert gas under pressure. The liquids are then forced out of the tanks and into the combustion chamber in the same way that paint or an insect spray is pushed out of an aerosol can. Nitrogen was the first pressurizing gas used, but carbon dioxide and air have also been employed. Although not exactly inert, in the strict meaning of the word, air is available almost anywhere anytime. For this reason, the WAC Corporal's tanks were pressurized with air. In some of the early rockets, the LOX was forced into the combustion chamber by its own vapor pressure which was generated as it warmed up.

The main disadvantage of pressurization is that the tanks must not only be strong enough to carry their load of liquids, but must also be able to withstand the internal pressure. This means, of course, that the thickness must be greater to attain the required higher strength, which all adds up to heavier tanks.

In large rockets, the dead-weight problem becomes acute, and the extra weight required by pressurization had to be avoided, if at all possible. A very neat solution appeared to be the substitution of pumps for gas pressure, provided that the pumps—and their power source—could be made light enough. Designing the pumps was not too difficult, inasmuch as high-speed centrifugal pumps did not constitute a new concept, but the second provision produced some severe headaches.

From the first, it was taken for granted that the most suitable source of power for the pumps would be some sort of gas turbine. Dr. Goddard developed a small generator for supplying hot pressurized gas to his turbines. The generator was actually a small combustion chamber designed for burning an oxygen-gasoline mixture having a large excess of oxygen. The hot gas, delivered under pressure, was a mixture of oxygen and combustion gases. To drive the turbopumps of their V-2, the Germans used steam produced by the decomposition of high-purity hydrogen peroxide—the same stuff to which so many blondes owe their golden tresses.

In a typical modern liquid-propellant rocket, the turbopumps are driven by combustion gases from a small combustion chamber-gas generator, burning either a solid or liquid propellant. If the latter, the gas generator, itself, must be fed propellant at a rapid rate. Some provision must be made, therefore, either to provide small gas-pressurized propellant supply, or "bleed off" enough pump-pressurized propellant from the main supply to run the gas generator. For obvious reasons, the latter method is sometimes referred to as the "bootstrap" technique. When it is used, the turbines must be started by compressed air.

Perhaps the most important recent fuel-pump development is that of a high-performance pump having a sufficiently high capacity and able to operate at a temperature low enough to deliver liquid hydrogen to the combustion chamber. This made a liquid-hydrogen rocket a possibility—rather than just a dream.

In recent years, both solid and liquid propellants have been the subject of a great deal of research and, as a result, both have been improved enormously. Much of the work on solid propellants has been to improve processing and manufacturing techniques. Lately, a lot of effort has been expended on the development of bigger and better grains for satellite boosters and such. On the other hand, most of the recent effort on liquid propellants has been to develop ever more energetic bipropellant combinations.

Nearly all of the solid propellants, currently in use are the composite type—only small rockets use double-base propellants these days—but most of them bear little resemblance to our old friends of a few pages back, what with their load of plasticizers, stabilizers, and various additives to modify their burning characteristics and ballistic performance. Great strides have been made in increasing structural strength and resistance to mechanical shock, and in reducing sensitivity to temperature change.

Composite propellants are safer and easier to manufacture than the double-base types. They can be cast, molded under pressure, extruded, and machined to any desired shape, and it is a relatively simple matter to alter their formulations to modify their physical and chemical characteristics.

One of the most important advances in solid-propellant technology has been the development of techniques for manufacturing large grains. As grains become larger, the difficulty of manufacturing them increases out of all proportion to their increase in size.

The really big grains are cast. The knotty problem was to produce the casting without bubbles, cracks, or other flaws that might result in structural failure and possible blowups. For casting, it is necessary to have the propellant in the liquid state, and this must be accomplished without the use of volatile solvents such as those used in double-base propellants. (The solvents volatilize and produce bubbles.) Liquefaction is attained by the use of heat and plasticizers. Cracking is eliminated by careful temperature control, and by the use of additives to reduce "mold shrinkage."

The grain must be uniform in composition throughout its mass: i.e., there must be no fuel-rich or oxidizer-rich regions that will burn faster or slower than the rest of the grain. This can only be accomplished by extremely accurate control of mixing and pouring procedures.

Large solid grains have a nasty habit of heating themselves up on the inside. Even at low temperatures, some chemical action takes place between the fuel and oxidizer. At ordinary ambient temperatures, the oxidation proceeds so slowly that the

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small amount of heat produced can escape by conduction through the propellant to the outside. Because solid propellants are poor thermal conductors, however, only a low rate of heat generation can be taken care of in this way. As ambient temperatures increase, oxidation proceeds at a greater rate, and a point is reached faster than it can escape. When this happens, the temperature of the propellant naturally rises, the chemical action proceeds more rapidly, the temperature rises still more, et cetera, et cetera, and "thar she blows"! This is much the same thing that sometimes happens to a heap of oily rags in the corner of the garage—spontaneous combustion.

The exact temperature at which a propellant deflagrates is called its *cook-off temperature*. The maximum safe ambient temperature for any particular grain depends upon the chemical properties of the propellant, its thermal conductivity, and the maximum distance from interior regions of the propellant mass to the nearest point on the surface from which heat can escape. Obviously, the development of a propellant for large grains involves more than just attaining high specific impulse.

Charges for very large rockets are usually made up of incremental charges, or grains, cemented together. If the individual charges are cemented end-to-end, the assembly is called a *segmented charge*. Another scheme is to use individual charges shaped in cross section—with due allowance for perforation requirements—like a slice of pie, cementing them together to form cylinders. The

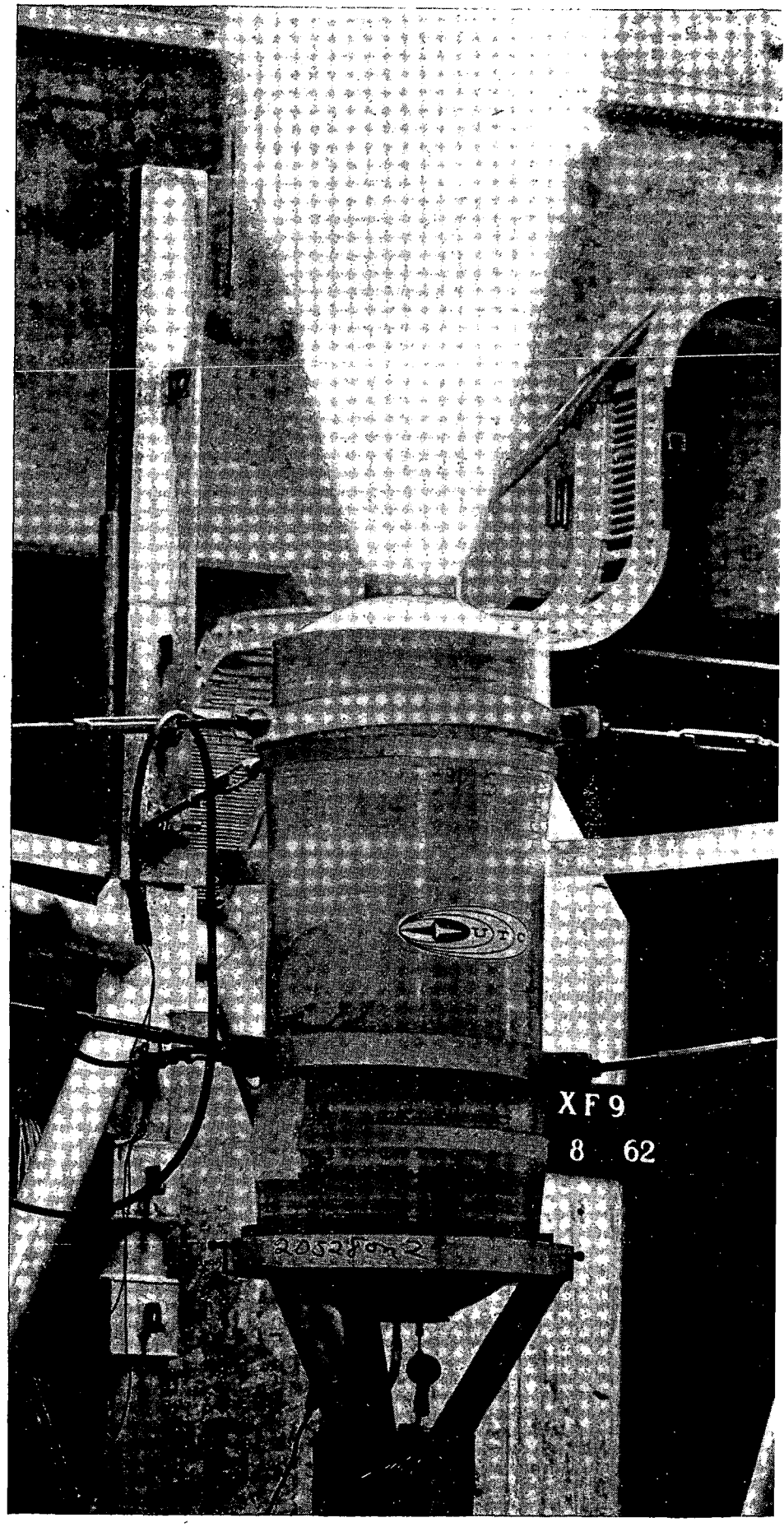

Fig. 10: This motor embodies two important recent developments in solid-propellant technology. As far as can be determined, it is the world's first segmented solid-propellant motor to be fired in a glass-filament-wound case. Construction of the motor was made possible by the development of light "flight-weight" metal joints to secure the segments together.

Courtesy: United Technology Corporation.

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cylindrical assemblies may then be cemented together end-to-end to form a larger total charge, if desired. This is known as a *sectored charge*. Both of these schemes get around the extreme difficulties of casting gigantic charges in one piece, although the individual charges may each weigh several thousand pounds.

One serious drawback to the use of solid propellants in large rockets has been the difficulty of making big motor tubes, or cases, that will withstand the internal pressures and structural stresses and yet not be prohibitively heavy. (Motor cases for smaller rockets, with few exceptions, are made of steel.) It now appears that that particular problem is about licked by the use of glass and plastics. It has long been known that fine filaments of a number of materials exhibit fantastic tensile strength. Perhaps the most outstanding material, in this respect, is glass. Glass can be drawn into filaments of almost any degree of fineness—from a few hundred-thousandths of an inch up—of any length desired, which is another factor in its favor. Filaments of one type of glass have a tensile strength of 700,000 to 800,000 pounds per square inch. But each glass filament, because of its minute cross-sectional area, will support only a minute load. The problem, therefore, is to take advantage of the great strength of the individual filaments in a practical way: i.e., make them support large loads.

Two hundred and four filaments, each of which is so fine that a strong magnifying glass is required to see it, are twisted together to make a fine thread. The thread is referred to as an *end*. If a number of ends are twisted together to form a sort of yarn, the result is called *roving*. Roving may be designated as single-end, 20-, 40-, 60-, or 80-end depending—you guessed it!—on the number of ends it contains. The next step is to wind the roving on a collapsible mandrel or a plaster form.

In a cylindrical case, the internal pressure generates almost exactly twice as much circumferential, or hoop, stress—in the direction "around" the cylinder—as axial stress—in the "end-to-end" direction. By using different winding patterns, it is possible to provide any desired strength in either the hoop or axial direction. Using only as much glass reinforcement as is necessary to take care of the stresses in the two directions results in a weight saving, and is one of the advantages of wound cases over cases of other types. For example, a steel case strong enough to withstand the hoop stress, is, of necessity, twice as strong as is necessary to carry the axial stress, and is a third heavier than necessary from the standpoint of strength.

As the glass is wound, it is either coated with an organic resin, generally an epoxy adhesive, which subsequently cures (hardens), or the roving is factory-coated with partially

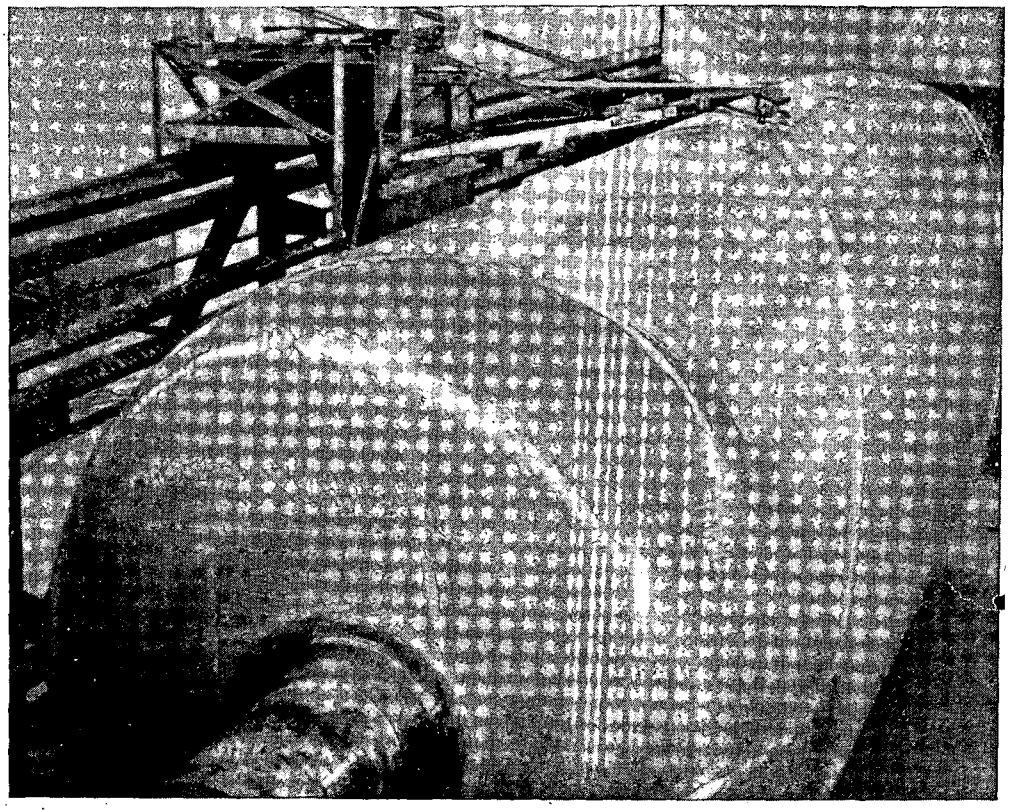

Fig. 11: An automatic machine winding a helical pattern on an experimental glass-filament-wound solid propellant motor case. Single-end rovings are laid side-by-side to form what looks like tape in the photo. An "end" consists of 204 filaments twisted together to form a fine thread. "Roving" may be any number of ends twisted together. The wet-winding technique employed here consists in coating the roving, as it is wound, with liquid organic resen adhesive that cures (hardens) after winding. Another method is to use roving coated with partially cured resin which is then fully cured after winding.

Courtesy: Lamtex Industries, Inc.

Fig. 12: The motor case shown in Fig. 11 after winding was completed. Circular areas on the end will be cut out to provide openings for installation of nozzle ports. The case shown here is approximately the same size as the Minuteman first stage.

Courtesy: Lamtex Industries, Inc.

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cured resin which is cured after winding. After a sufficient number of layers have been wound on, the mandrel is removed, or the plaster form is broken out. The tube thus formed contains about eighty-five per cent glass and fifteen per cent resin. The material is, of course, nowhere near as strong as the individual glass filaments, but still is stronger—weight for weight—than steel.

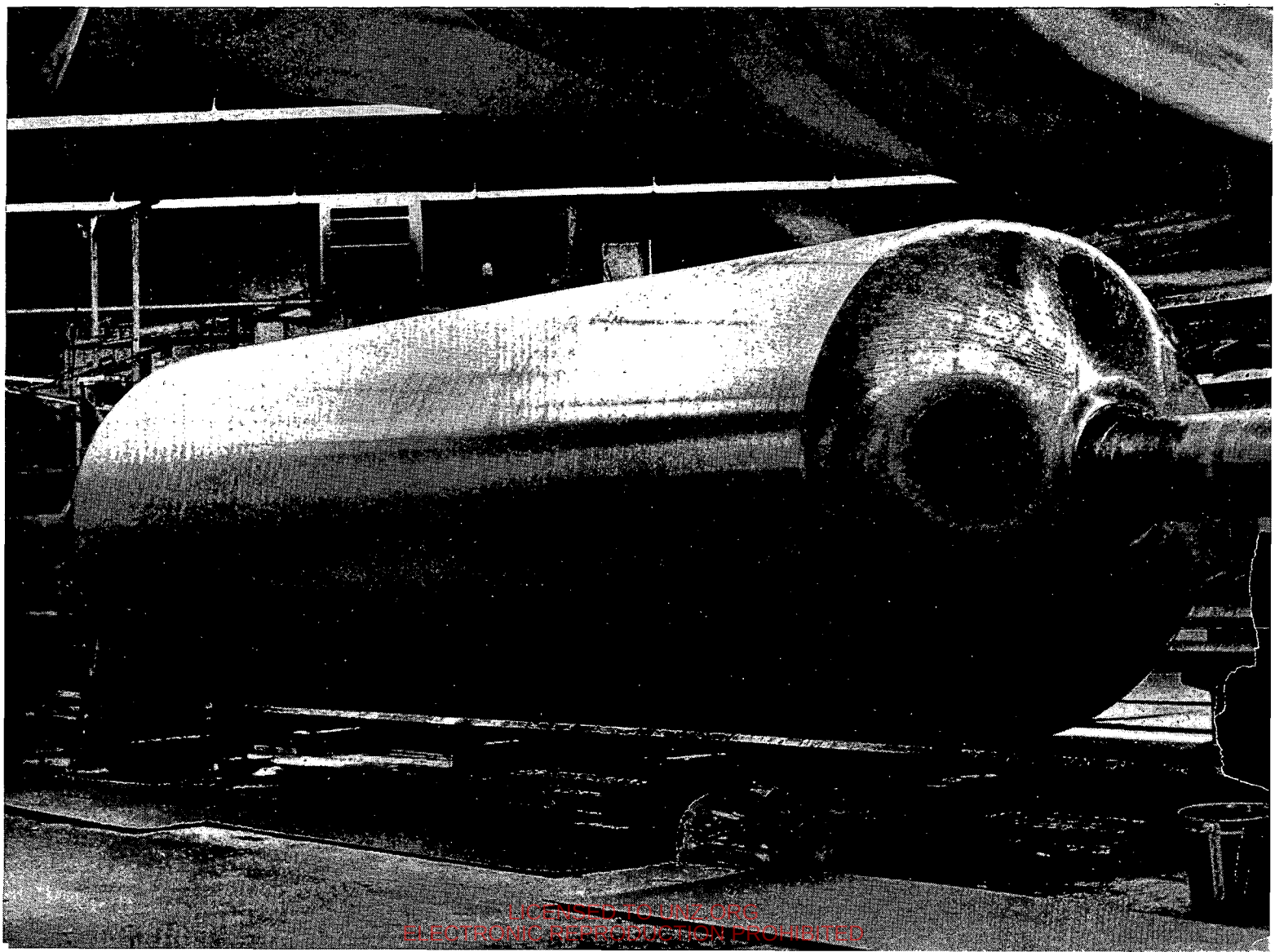
Filament-wound motor cases have advantages other than that of high strength-to-weight ratio. The material of which they are made is, itself, a good thermal insulator, so they do not require any additional protection from aerodynamic heating caused by high-speed passage through the denser layers of the atmosphere. Last, but certainly not least, they are much less expensive—in both money and time—than their steel counterparts.

Only a few years ago, many rocket people were convinced that it would be impossible to produce a solid-propellant motor more than a couple of feet in diameter. As of the time of this writing, solid charges more than 200 inches in diameter have been fired successfully, and 260-inch solid-propellant motors are being injected.

Although recent R&D emphasis is still on processing and manufacturing, the improvement of solid-propellant formulations is not being neglected entirely. Specific impulse has been increased by the introduction of finely powdered metals such as aluminum, magnesium, boron, and beryllium to raise the combustion temperature, and fluorocarbon compounds show considerable promise as binders for metallic fuels.

In addition to their high energy content, fluorocarbons are denser than the conventional hydrogen-carbon compounds usually employed as binders or matrix materials. Since they contain fluorine, which is the most powerful oxidizer known, there is no need to add an oxidizer such as potassium nitrate or ammonium perchlorate.

Reference to elements other than oxygen as oxidizers or *oxidizing agents* may be somewhat confusing to the layman. To a chemist, "oxidation" does not necessarily involve oxygen. The reason for the more general meaning of the term is rather interesting. After its discovery by Priestly in 1774, oxygen was observed to combine with many other elements, and the reaction involved quite naturally became known as *oxidation.* Later, when the electronic



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THE BIG FUEL FEUD

nature of chemical reactions was understood, it was found that in all instances in which oxygen combined with another element, the valence of that element was increased.

In the light of the (then) new theory, the increase in valence was interpreted as an indication that each atom of the element in question had lost one or more electrons from its outer (valence) ring. Hence, by extension, any element that exhibits an increase in valence upon taking part in a reaction is said to be *oxidized*. Actually, the lost electrons are acquired by the atoms of the oxidizing element—which thereupon undergoes a reduction in valence and is said to be *reduced*. The element losing electrons is called a *reducing agent*. Reactions of the above type, in which an ionic bond is formed, are called *oxidation-reduction* reactions.

But to get back to fluorine: it is a member of the halogen family which also includes chlorine, bromine, and iodine, and is the most chemically active of the elements. It is so active that it combines quite readily with almost any other element, including members of its own family. Within the last year or so, it has even been made to combine with xenon, one of the rare gases that had always been thought to be absolutely chemically inert.

Because of its vicious chemical activity and the difficulty of storing and handling it, fluorine is fantastically expensive.

There is, of course, a strong temptation to use fluorine as an oxidizer in rocket propellants. However, there is a serious drawback to this, especially with respect to solid propellants: fluorine is a gas at ordinary temperatures—it boils at —306°F. Solid fluorine compounds have been tried but, in most instances, they have proved disappointing. So much energy is required to free the fluorine from its compound so it can act as an oxidizer, that the net gain in energy is hardly worth the effort.

The use of frozen substances that are liquids or gases at ordinary temperatures has been suggested for solid propellants. For example, it would be theoretically possible to freeze a mixture of liquid oxygen and liquid hydrogen, since pure oxygen and hydrogen do not ignite spontaneously when mixed: i.e., they are not hyperbolic. For still more energy, frozen ozone could be substituted for oxygen. Cryogenic solid propellants, however, are probably a rather long way in the future.

The most spectacular recent developments have been in the realm of liquid propellants, and the most spectacular single development is that of the liquid hydrogen-LOX engine—despite the fact that flight testing has not been too successful to date.

As mentioned previously, hydrogen is a fine thrust-producing fuel because of the low molecular weight of its reaction products. That characteristic, combined with its high heat of reaction with oxidizers in general, gives it the capability of producing specific impulses higher than can be obtained from any other fuel.

Hydrogen, like other cryogenic liquids, is tricky stuff to store. In addition to being able to diffuse through almost anything, given enough time —only helium is worse in that respect—its boiling point is —422°F., and the critical temperature—the temperature above which it will remain a gas, regardless of its pressure —is —400°F. Keeping *anything* that cold takes a bit of doing, but in the case of hydrogen the job is especially tough.

There are two kinds of hydrogen—and I don't mean different isotopes. Hydrogen is diatomic: i.e., its molecules each consist of two hydrogen atoms. The nucleus of each atom is spinning like a top. If the two atomic nuclei in a molecule spin in the same direction—both clockwise or counterclockwise—we have a molecule of *ortho-hydrogen*. If one nucleus spins clockwise and the other counterclockwise, the molecule is one of *para-hydrogen*. Ordinary hydrogen is a mixture of ortho and para molecules, the exact ratio depending on the temperature but never greater than the three-ortho-to-one-para that is obtained at room temperature.

Though chemically identical, para- and ortho-hydrogen differ a little in melting and boiling points and thermal conductivity.

At very low temperatures, the proportion of para to ortho is considerably higher than at higher temperatures. At the boiling point of hydrogen, the para begins converting to ortho, releasing some heat in the process. This raises the temperature, accelerating the para-ortho conversion, which releases more heat, thereby further increasing the conversion rate—et cetera, et cetera. Meanwhile, the added heat is also busily engaged in converting more of the liquid to gas, thereby increasing the pressure in the container. Here again, we have a runaway process, the results of which can be disastrous. And in storage, it is awfully hard to avoid having the temperature get as "high" as 422 degrees below zero!

The most obvious way to avoid such trouble is to convert as much as possible of the para-hydrogen to ortho-hydrogen prior to storage. Fortunately, there are a number of ways in which this can be done. For example, the conversion takes place at a high rate in the presence of platinized asbestos. In this way, the conversion is gotten out of the way and everyone is happy. Everyone, that is, except the guys who have to handle the stuff!

Research on the production and handling of liquid hydrogen is underway, but it will be a long time before it is as safe to handle as LOX, for example. It is still a very dangerous business.

Most of the arguments in favor of

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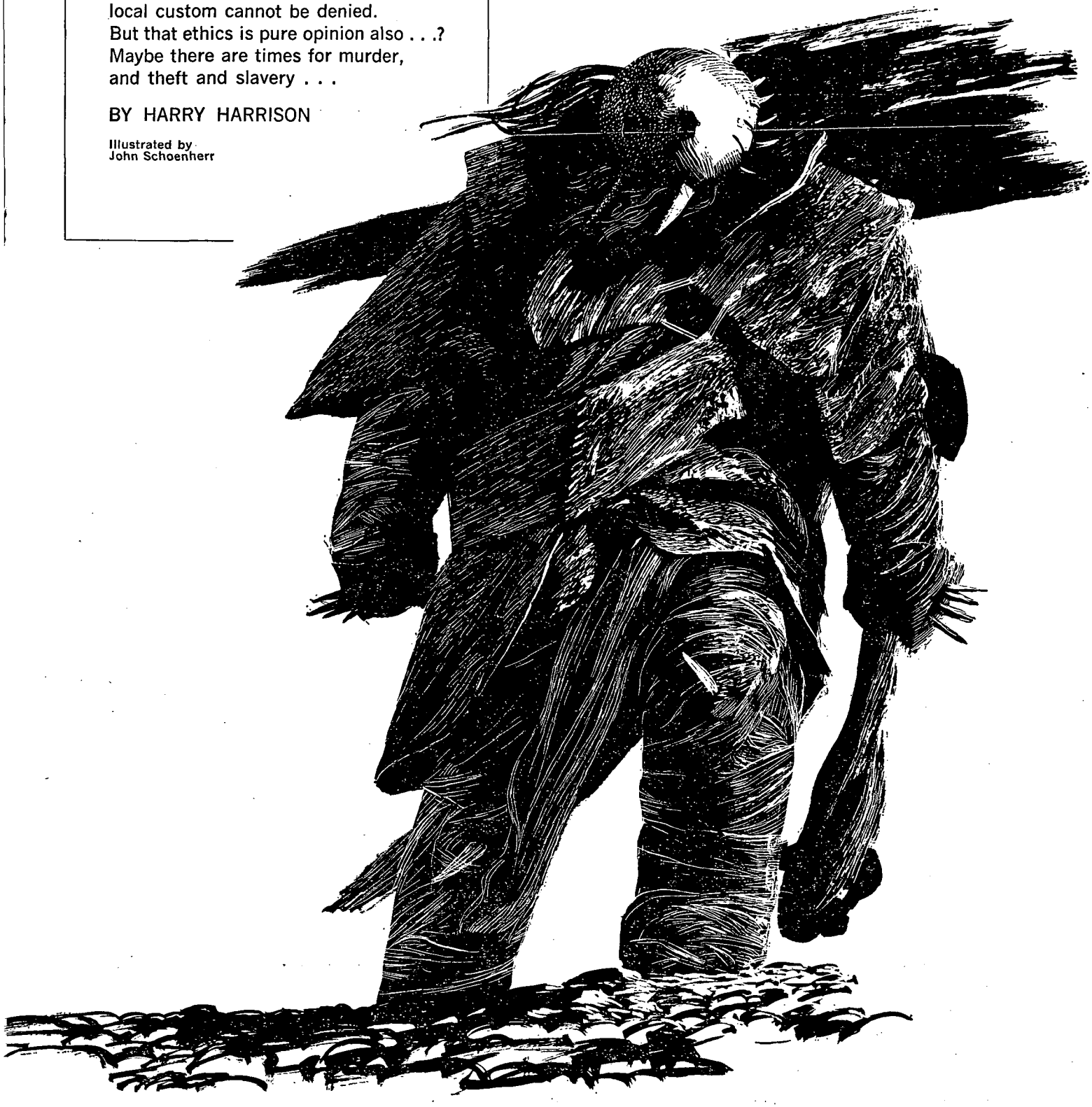
THE ETHICAL ENGINEER

First of Two Parts.
That mores is strictly a matter of local custom cannot be denied. But that ethics is pure opinion also . . .? Maybe there are times for murder, and theft and slavery . . .

BY HARRY HARRISON

Illustrated by John Schoenherr



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All nature is but art, unknown to thee;
All chance, direction which thou canst not see;
All discord, harmony not understood;
All partial evil, universal good:
And, spite of pride, in erring reasons spite,
One truth is clear, Whatever is, is right.

Alexander Pope
Essay on Man

I

Jason dinAlt looked unhappily at the two stretchers as they were carried by. "Are they at it again?" he asked.

Brucco nodded, the scowl permanently ingrained now on his hawklike face. "We have only one thing to be thankful for. That is—so far at least—they haven't used any weapons on each other."

Jason looked down unbelievingly at the shredded clothing, crushed flesh and broken bones. "The absence of weapons doesn't appear to make much difference when two Pyrrans start fighting. It seems impossible that this damage could be administered bare-handed."

"Well it was. Even you should know that much about Pyrrus by now. We take our fighting very seriously. But they never think how much more work it makes for me. Now I have to patch these two idiots up and try to find room for them in the ward." He stalked away, irritated and annoyed as always. Jason usually laughed at the doctor's irascible state, but not today.

Today, and for some days past, he had found himself living with a persistent feeling of irritation, that had arrived at the same time as his discovery that it is far easier to fight a war than to administer a peace. The battle at the perimeter still continued, since the massed malevolence of the Pyrran life forms were not going to call a truce simply because the two warring groups of humans had done so. There was battle on the perimeter and a continual feeling of unrest inside the city. So far there had been very little traffic between the city Pyrrans and those living outside the walls, and what contact there had been usually led to the kind of violence he had just witnessed. The only minor note of hope in this concert of discord was the fact that no one had died—as yet—in any of these fearsome hand-to-hand conflicts. In spite of the apparent deadliness of the encounters all of the Pyrrans seemed to understand that, despite past hatreds, they were all really on the same side. A distant rumble from the clouded sky broke through his thoughts.

"There is a ship on the radar," Meta said, coming out of the ground-control office and squinting up at the overcast. "I wonder if it is that ecology expedition that Brucco arranged—or the cargo ship from Ondion?"

"We'll find out in a few minutes," Jason said, happy to forget his troubles for the moment in frank admiration, since just looking at Meta was enough to put a golden edge on this gloom-filled day. Standing there, head back searching the sky, she managed to be beautiful even in the formless Pyrran coverall. Jason put his arms around her waist and exacted a great deal of pleasure from kissing the golden length of her upstretched throat.

"Oh, Jason . . . not now," she said in exasperation. Pyrran minds, by necessity, run along one track at a time, and at the present moment she was thinking about the descending spaceship. With a quick motion, scarcely aware of her action, she pulled his hands from her and pushed him away, an easy enough thing for a Pyrran girl to do. But in doing so she half fractured one of his wrists, numbed the other, and knocked Jason to the ground.

"Darling . . . I'm sorry," she gasped, suddenly realizing what she had done, bending quickly to help him up.

"Get away, you lady weight-lifter," he growled, pushing aside the proffered hand and struggling to his feet. "When are you going to realize that I'm only human, not made of chrome steel bars like the rest of your people . . ." He stifled the rest of his words in disgust, at himself, his temper, this deadly planet and the cantankerousness of its citizens that was scratching away at his nerves. He turned and stamped away, angry at himself for taking out his vile mood on Meta, but still too annoyed to make peace.

Meta watched him leave, trying to say something that would end this foolish quarrel, but unable to. The largest blank in the Pyrran personality was an almost complete lack of knowledge of human nature, and her struggle to fill in the gaps—gaps she was only just beginning to realize existed—was a difficult one. The stronger emotions of hate and fear were no strangers to her; but for the first time she was discovering how difficult and complex was this unusual feeling of love. She let Jason go because she was incapable of any other action. Of course she could stop him by force, but if she had learned anything in the past few weeks, it was the discovery that this was one area where he was very sensitive. There was no doubt that she was far stronger than he—physically—and he did not like to be reminded about it. She went back into the ground-control room, almost eager to deal with the impersonal faces of the dials and scopes, material and unchanging entities that posed no conflicting problems.

Jason stood at the edge of the field and watched the ship come in for a landing, his anger forgotten temporarily in the presence of this break in routine. Perhaps this was the shipful of scientific eggheads that Brucco was expecting; he hoped so. It would be a pleasant treat to have a conversation with someone about a topic more universal than the bore dimensions of guns. With practiced eye he watched the landing which was a little sloppy, either a new pilot or an old one who didn't care much. It was a small ship so not many people would be aboard. Then the spacer turned for a moment, in

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a landing correction, and he had a quick glimpse of a serial number and tantalizingly familiar insignia on its stern—where had he seen that before?

The ship touched down and the flaring rockets died. There was only the click of cooling metal from the ship: no one emerged, nor did any of the Pyrrans seem interested enough in the newcomer to approach it. That must mean that no one had any business with it, and, of course, no curiosity either, for this along with imagination was in very short supply on the war-torn planet. Since no one else was making any moves, Jason went forward to investigate for himself.

A stingwing that had escaped the perimeter guards dived towards him and he blasted it automatically with his gun. The corpse thudded to the ground and the soil churned around it as the insectile scavengers fought for the flesh; only bare bones remained by the time he had taken two paces.

A muffled whine of motors told him that the lower hatch was opening, and Jason watched as a hairline crack appeared in the thick metal, then widened as the heavy door ground outwards. Through the opening he had a glimpse of a figure muffled in a heavy-duty spacesuit. That must be Meta's work, she would have contacted the ship by radio while it was on its way down and explained the standing orders that no offworlders were to be allowed out of their ships unless wearing the heaviest armor. Since the armed truce between the human inhabitants there had been a lessening of the relentless warfare the Pyrran life forms waged against the city, but only to a slight degree. Deadly beasts still abounded, and the air was thick with toxic diseases. A stranger, unprotected, would be ill in five minutes, dead within ten—or much sooner if a horndevil or other beast got to him in the interval.

Jason felt a justified pride that he could walk this planet under his own power. The natives, adapted to the deadliness and heavy gravity since birth, were still his superiors, but he was the only offworlder who could stand the dangers of Pyrrus. His gun whined out of his power holster into his waiting hand as he searched for some target to use his talents on. An armored piece of nastiness, with a lot of legs, was crawling into hiding under a rock and he blasted it neatly with a single shot. The gun snapped back into the holster and he turned to the open door of the spacer, his morale greatly improved.

"Welcome to Pyrrus," he told the ungainly figure that clumped out of the ship. There was a hefty maser-projector clutched in the armored gloves and whoever was inside the suit, the face was invisible behind the thick and tinted faceplate, seemed exceedingly nervous, turning to look in all directions.

"Don't worry," Jason said, fighting to keep a tone of smug satisfaction out of his voice, "I'll take care of things for you. I don't know what kind of horror stories you may have heard about Pyrrus—but they're all true. That's a nice looking heat ray you have there, but I doubt if you could move fast enough to use it."

The figure lowered the gun and fumbled for a switch on the front of the space armor, it clicked and a speaker diaphragm rustled.

"I'm looking for a man called Jason dinAlt. Can you tell me if he is on this planet or if he has left?"

It was impossible to tell the speaker's tone from the rasping diaphragm, and no face was visible that might betray an emotion. This was the moment when Jason should have shown caution, and have remembered that there were thousands of policemen scattered across the galaxy who would heartily enjoy putting him under arrest. Yet he couldn't imagine any of them going to the trouble of following him here. And certainly there could be very little danger from a spacesuited man with a rifle, not to the man who had learned to take Pyrrus on its own terms, and live.

"I'm Jason dinAlt," he said. "What do you want me for?"

"I've come a long way to find you," the speaker rasped. "Now"—the gloved hand pointed—"what is THAT?"

Jason's reactions were instantaneous, conditioned to move without thought. He wheeled, crouched, the gun in his hand and finger quivering lightly on the trigger, pointed in the indicated direction. There was nothing unusual to be seen, just an empty field and the control building at the edge.

"Whatever are you talking about . . ." Jason asked, then stopped as it became very obvious what the stranger had been talking about. The large, flanged mouth of the maser-projector ground into the small of his back. His own gun snapped halfway out of its holster, buzzed briefly, then slipped back as he realized his position.

"That's much better," the stranger said. "If you attempt to move, turn, lower your gun hand or do anything I don't like I'll pull this trigger and . . ."

"I know," Jason sighed, careful to stand with every muscle frozen. "You will pull the trigger and burn a nice round hole through my backbone and intestines. But I would just like to know why? Who is it that is so interested in my worthless old carcass that they were willing to pay interstellar freight charges to send you and that oversize toaster all the way here in order to threaten it?"

Jason was only talking to kill time, since he knew this situation would not stay static for long, not on Pyrrus. He was completely right because before he had finished the ground-control door burst open and Meta ran out, circling to the left. At the same moment Kerk appeared from behind the building, his Pyrran reflexes absorbing the situation in an instant and with no perceptible delay he ran in the opposite direction. Both Pyrrans had their guns ready and closed in with the merciless precision of trained predators.

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"Tell them to stop," the suit speaker grated at Jason. "I'll shoot you if they try anything."

"Hold it!" Jason shouted, and the running Pyrrans stopped instantly. "Don't come any closer and whatever you do don't shoot." He half-turned his head and spoke in a quieter voice to the suited figure behind him. "Now you see where you stand. Lower the gun and get back into your ship, I guarantee you'll stay alive if you do that at once."

"Don't try and buff me, dinAlt," the maser barrel pushed harder against his back. "You are my prisoner and your friends can't save you. Start walking backwards now—I'll stay right behind you."

"Look," Jason said calmly, not permitting himself to get angry. "Those are *Pyrrans* out there. Either of them could kill you so quickly that you couldn't possibly have time to pull that trigger. I'm saving your life—though I don't know why I'm bothering—so be a good boy and get back into your ship and go home and we'll give you a T for trying."

"Could I have him, please Kerk?" Meta called out, the deadly assumption of her remark punctuating Jason's logic. "After all, Jason means more to me than you. Shall I kill him yet, Jason?"

"Just shoot his gun hand off, Meta," Kerk told her, in the same emotionless tone. "I want to know who this is, why he came here, before he dies."

"Get back into your ship, you fool," Jason hissed. "You've got only seconds to live."

"Start walking backwards," his captor said. "You are under arrest. I'll count to three, then shoot. One . . . two . . ."

Jason shuffled a cautious step to the rear and the Pyrran guns snapped up at the same instant, extended at arm's length. Jason was so close to the man in the spacesuit that the guns could have been pointed at him, the eyes sighting carefully over the dark muzzles.

"Don't shoot!" Jason shouted to his friends.

"Don't worry," Kerk called back. "We won't hit you."

"I know that—it's this idiot here that I'm worrying about. You just can't shoot him for trying to do his job. In fact I'm surprised to find out that there is one honest cop left on any of the places I've been."

"Don't talk so crazy," Meta said with maddening sweetness. "We'll kill him, Jason. We'll take care of you."

Anger hit him. "You will NOT take care of me because I can take care of myself. Either of you kill him and so help me I'll kill you." Jason shuffled backwards faster now until his legs hit the lower edge of the hatch. He clambered into it and burst out laughing at the dumfounded expressions of his friends' faces. The laugh died as something pricked the back of his neck. The pressure of the gun was gone and he swung around, surprised to see the floor rushing up towards him, but before it struck him blackness descended.

Consciousness returned, accompanied by a thudding headache that made Jason wince when he moved, and when he opened his eyes the pain of the light made him screw them shut again. Whatever the drug was that had knocked him out, it was fast working, and seemed to be oxidized just as quickly. The headache faded away to a dull throb and he could open his eyes without feeling that needles were being driven into them. He was seated in a standard spacechair that had been equipped with wrist and ankle locks, now well secured. A man sat in the chair next to him, intent on the spaceship's controls; the ship was in flight and well into space. The stranger was working the computer, cutting a tape to control their flight in jump-space.

Jason took the opportunity to study the man. He seemed to be a little old for a policeman, though on second thought it was really hard to tell his age. His hair was gray and cropped as short as a skull cap, but the wrinkles on his leathery skin seemed to have been caused more by exposure than advanced years. Tall and firmly erect, he appeared underweight at first glance, until Jason realized this effect was caused by the total absence of any excess flesh. It was as though he had been cooked by the sun and leeched by the rain until only bone, tendon and muscle were left. When he turned his head the muscles stood out like cables under the skin of his neck and his hands at the controls were the browned talons of some bird. A hard finger pressed the switch that actuated the jump control, and he turned away from the board to face Jason.

"I see you are awake. It was a mild drug. I did not enjoy using it, but it was the safest way."

When he talked his jaw opened and shut with the seriousness of a bank vault. The deep-set and cold blue eyes stared fixedly from under dark brows. Jason stared back just as steadily and chuckled.

"I suppose you didn't enjoy using the maser-projector either, nor threatening to cook holes in me. For a cop you seem to be very tender hearted."

"I did it only to save your friends. I did not want them to get hurt."

"Get hurt!" Jason roared with laughter. "Space-cop, don't you have any idea what Pyrrans are like, or what kind of a setup you were walking into? Don't you realize that I saved your life—though I really don't know why. Call me a natural humanitarian. You may have a swollen head and a ready trigger-finger, but you were so far out of your class that you just weren't in the race. They could have blasted you into pieces, then shot the pieces into smaller pieces, while you were still thinking about pulling the trigger. You should just thank me for being your savior."

"So you are a liar as well as a thief," Jason's captor answered with no change of expression. "You attempt to play on my sympathies to gain your freedom. Why should I believe this story? I came to arrest you, threatening to kill you if you didn't submit, and your

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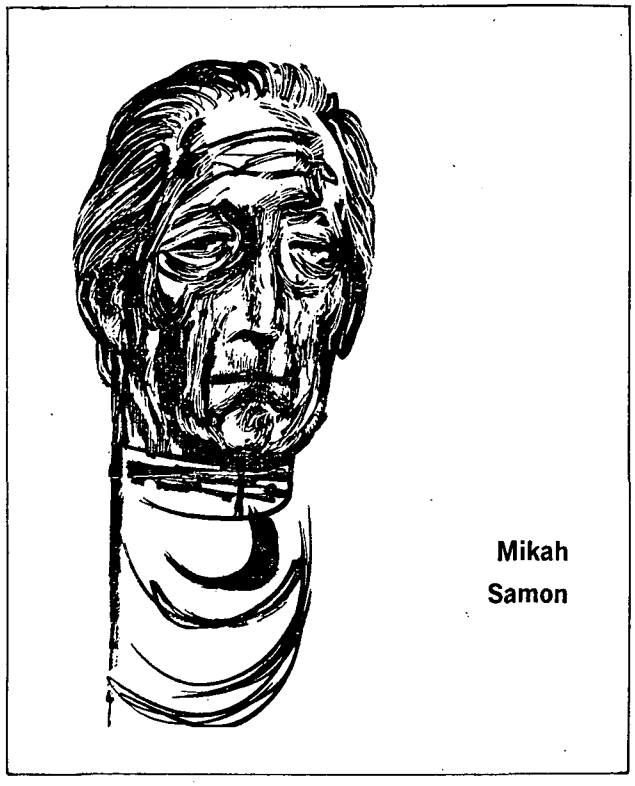

Mikah Samon

friends were there ready to defend you. Why should you attempt to save my life? It does not make sense." He turned back to the controls to make an adjustment.

It didn't make sense, Jason agreed completely. Why had he saved this oaf who meant nothing to him? It was not an easy question to answer, though it had seemed so right at the time. If only Meta hadn't said that *they* would take care of him; he knew they could and was tired of it. He could take care of himself: he felt the anger rising again at the remembered words. Was that the only reason he had let this cop capture him? To show the Pyrrans that he was able to control his own destiny? Was the human ego such a pitiable thing that it had to keep reassuring itself of its own independence or lie down on its back and curl up its toes?

Apparently it was. At least his was. The years had taught him a certain insight into his own personality and he realized that his greedy little subconscious had collected all the cues and signals from the encounter at the spaceport and goaded him into a line of action that looked uncomfortably like suicide. The arrival of the stranger, the threat to himself, the automatic assumption by the Pyrrans that they would take care of him. Apparently his ego and his subconscious felt that he had been taken care of too long. They had managed to get him into this spot from which he could only be extricated by his own talents, far away from Pyrrus and the pressures that had been weighing on him so long.

He took a deep breath and smiled. It wasn't such a bad idea after all. Stupid in retrospect, but the stupidity could hopefully be kept in the past. Now he had to prove that there was something other than a death wish in his subconscious flight from Pyrrus, and he must find a way to reverse positions with this cop, whoever he was. Which meant that he had to find out a little more about the man before making any plans.

"I'm afraid you have the advantage of me, officer. How about telling me who you are and showing me a warrant or something under which you are performing this deed of interstellar justice."

"I am Mikah Samon. I am returning you to Cassylia for trial and sentencing."

"Ah, yes," Jason sighed. "I'm not surprised to hear that they are still interested in finding me. But I should warn you that there is very little remaining of the three-billion, seventeen-million credits that I won from your casino."

"Cassylia doesn't want the money back," Mikah said as he locked the controls and swung about in his chair. "They don't want you back either. You are their planetary hero now. When you escaped with your ill-gotten gains they realized that they would never see the money again. So they put their propaganda mills to work and you are now known throughout all the adjoining star systems as 'Jason 3-Billion', the living proof of the honesty of their dishonest games, and a lure for all the weak in spirit. You tempt them into gambling for money instead of working honestly for it."

"Pardon me for being thick today," Jason said, shaking his head rapidly to loosen up the stuck synapses. "I'm having a little difficulty in following you. What kind of a policeman are you to arrest me for trial after the charges have been dropped?"

"I'm not a policeman," Mikah said sternly, his long fingers woven tightly together before him, his eyes wide and penetrating. "I'm a believer in Truth—nothing more. The corrupt politicians who control Cassylia have placed you on a pedestal of honor. Honoring you, another—and if possible—a more corrupt man, and behind your image they have waxed fat. But I am going to use the Truth to destroy that image, and when I destroy the image I shall destroy the evil that produced it."

"That's a tall order for one man," Jason said calmly —much calmer than he really felt. "Do you have a cigarette?"

"There is, of course, no tobacco or spirits on this ship. And I am more than one man. I have followers. The Truth Party is already a power to be reckoned with. We have spent much time and energy in tracking you down, but it was worth it. We have followed your dishonest trail into the past, to Mahaut's Planet, to the Nebula Casino on Galipto, through a series of sordid crimes that turns an honest man's stomach. We have warrants for your arrest from each of these places, in some cases even the results of trials and your death sentence."

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"I suppose it doesn't bother your sense of legality that those trials were all held in my absence" Jason asked. "Or that I have only fleeced casinos and gamblers —who make their living by fleecing suckers?"

Mikah Samon wiped away this consideration with a wave of his hand. "You have been proven guilty of a number of crimes. No amount of wriggling on the hook can change that. You should be thankful that your revolting record will have a good use in the end. It will be the lever with which we shall topple the grafting government of Cassylia."

"I'm beginning to be sorry that I stopped Kerk and Meta from shooting you," Jason said, shaking his head in wonder. "I have a very strong suspicion that you are going to cause yourself—and a lot of other people—a good deal of trouble before this thing is over. Look at me for instance—" he rattled his wrists in their restraining bands. The servo motors whined a bit as the detector unit came to life and tightened the grasp of the cuffs, limiting his movement. "A little while ago I was enjoying my health and freedom and I threw it all away on the impulse to save your life. I'm going to have to learn to fight those impulses."

"If that is supposed to be a plea for mercy, it is sickening," Mikah said. "I have never taken favors nor do I owe anything to men of your type. Nor will I ever."

"*Ever* like *never* is a long time," Jason said very quietly. "I wish I had your serenity of mind about the sure order of things."

"Your remark shows that there might be hope for you yet. You might be able to recognize the Truth before you die. I will help you, talk to you and explain."

"Better the execution," Jason choked.

II

"Are you going to feed me by hand—or unlock my wrists while I eat?" Jason asked. Mikah stood over him with the tray, undecided. Jason gave a light verbal prod, very gently, because whatever else he was, Mikah was not stupid. "I would prefer you to feed me of course, you'd make an excellent body servant."

"You are capable of eating by yourself," Mikah responded instantly, sliding the tray into the slots of Jason's chair. "But you will have to do it with only one hand. If you were freed you would only cause trouble." He touched the control on the back of the chair and the right wrist lock snapped open. Jason stretched his cramped fingers and picked up the fork.

While he ate Jason's eyes were busy. Not obviously, since a gambler's attention is never obvious, but many things can be seen if you keep your eyes open and your attention apparently elsewhere. A sudden glimpse of someone's cards, the slight change of expression that reveals a player's strength. Item by item his seemingly random gaze touched the items in the cabin: control console, screens, computer, chart screen, jump control chart case, bookshelf. Everything was observed, remembered and considered. Some combination of them would fit into the plan.

So far all he had was the beginning and the end of an idea. Beginning: He was a prisoner in this ship, on his way back to Cassylia. End: He was not going to remain a prisoner—nor return to Cassylia. Now all that was missing was the vital middle. It looked impossible at the moment, but Jason never considered that it couldn't be done. He operated on the principle that you made your own luck. You kept your eyes open as things evolved and at the right moment you acted. If you acted fast enough, that was good luck. If you worried over the possibilities until the moment had passed, that was bad luck.

He pushed the empty plate away and stirred sugar into his cup. Mikah had eaten sparingly and was now starting on his second cup of tea. His eyes were fixed, unfocused in thought as he drank. He started slightly when Jason called to him.

"Since you don't stock cigarettes on this ship—how about letting me smoke my own? You'll have to dig them out for me since I can't reach the pocket while I'm chained to this chair."

"I cannot help you," Mikah said, unmoving. "Tobacco is an irritant, a drug and a carcinogen. If I gave you a cigarette, I would be giving you cancer."

"Don't be a hypocrite!" Jason snapped, inwardly pleased at the rewarding flush in the other's neck. "They've taken the cancer-producing agents out of tobacco for centuries now. And even if they hadn't—how does that affect this situation. You're taking me to Cassylia to certain death. So why should you concern yourself with the state of my lungs in the future?"

"I hadn't considered it that way. It is just that there are certain rules of life . . ."

"Are there?" Jason broke in, keeping the initiative and the advantage. "Not as many as you like to think. And you people who are always dreaming up the rules never carry your thinking far enough. You are against drugs. Which drugs? What about the tannic acid in that tea you're drinking? Or the caffeine in it? It's loaded with caffeine—a drug that is both a strong stimulant and a diuretic. That's why you won't find tea in spacesuit canteens. That's a case of a drug forbidden for a good reason. Can you justify your cigarette ban the same way?"

Mikah started to talk, then thought for a moment. "Perhaps you are right. I'm tired, and it is not important." He warily took the cigarette case from Jason's pocket and dropped it onto the tray. Jason didn't attempt to interfere. Mikah poured himself a third cup of tea with a slightly apologetic air.

"You must excuse me, Jason, for attempting to make you conform to my own standards. When you are in pursuit of the big Truths, you sometimes let the little Truths slip. I'm not intolerant, but I do tend to expect everyone else to live up to certain criteria I have set for

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myself. Humility is something we should never forget and I thank you for reminding me of it. The search for Truth is hard."

"There is no Truth," Jason told him, the anger and insult gone now from his voice since he wanted to keep his captor involved in the conversation. Involved enough to forget about the free wrist for a while. He raised the cup to his lips and let the tea touch his lips without drinking any. The half-full cup supplied an unconsidered reason for his free hand.

"No Truth?" Mikah weighed the thought. "You can't possibly mean that. The galaxy is filled with Truth, it's the touchstone of Life itself. It's the thing that separates Mankind from the animals."

"There is no Truth, no Life, no Mankind. At least not the way you spell them—with capital letters. They don't exist."

Mikah's taut skin contracted into a furrow of concentration. "You'll have to explain yourself," he said. "You're not being clear."

"I'm afraid it's you who aren't being clear. You're making a reality where none exists. Truth—with a small *T* is a description, a relationship. A way to describe a statement. A semantic tool. But capital *T* Truth is an imaginary word, a noise with no meaning. It pretends to be a noun but it has no referent. It stands for nothing. It means nothing. When you say 'I believe in Truth' you are really saying 'I believe in nothing'."

"You're wrong, you're wrong," Mikah said, leaning forward, stabbing with his finger. "Truth is a philosophical abstraction, one of the tools that mankind's mind has used to raise it above the beasts—the proof that we are not beasts ourselves, but a higher order of creation. Beasts can be true—but they cannot know Truth. Beasts can see, but they cannot see Beauty."

"Arrgh!" Jason growled. "It's impossible to talk to you, much less enjoy any comprehensible exchange of ideas. We aren't even speaking the same language. Aside from who is right and who is wrong, for the moment, we should go back to basics and at least agree on the meaning of the terms that we are using. To begin with—can you define the difference between *ethics* and *ethos?*"

"Of course," Mikah snapped, a glint of pleasure in his eyes at the thought of a good rousing round of hair-splitting. "Ethics is the discipline dealing with what is good or bad, or right and wrong—or with moral duty and obligation. Ethos means the guiding beliefs, standards or ideals that characterize a group or community."

"Very good, I can see that you have been spending the long spaceship-nights with your nose buried in the books. Now make sure the difference between those two terms is very clear, because it is the heart of the little communication problem we have here. Ethos is inextricably linked with a single society and cannot be separated from it, or it loses all meaning. Do you agree?"

"Well . . ."

"Come, come—you *have* to agree on the terms of your own definition. The ethos of a group is just a catch-all term for the ways in which the members of a group rub against each other. Right?"

Mikah reluctantly produced a nod of acquiescence.

"Now that we agree about that we can push on one step further. Ethics, again by your definition, must deal with any number of societies or groups. If there are any absolute laws of ethics, they must be so inclusive that they can be applied to *any* society. A law of ethics must be as universal of application as is the law of gravity."

"I don't follow you . . . ?"

"I didn't think you would when I got to this point. You people who prattle about your Universal Laws never really consider the exact meaning of the term. My knowledge of the history of science is very vague, but I'm willing to bet that the first Law of Gravity ever dreamed up stated that things fell at such and such a speed, and accelerated at such and such a rate. That's not a law, but an observation that isn't even complete until you add 'on this planet.' On a planet with a different mass there will be a different observation. The *law* of gravity is the formula

$$F = \frac{mM}{d^2}$$

and this can be used to compute the force of gravity between any two bodies anywhere. This is a way of expressing fundamental and unalterable principles that apply in all circumstances. If you are going to have any real ethical laws they will have to have this same universality. They will have to work on Cassylia or Pyrrus, or on any planet or in any society you can find. Which brings us back to you. What you so grandly call—with capital letters and a flourish of trumpets—'Laws of Ethics' aren't laws at all, but are simple little chunks of tribal ethos, oboriginal observations made by a gang of desert sheepherders to keep order in the house—or tent. These rules aren't capable of any universal application, even you must see that. Just think of the different planets that you have been on and the number of weird and wonderful ways people have of reacting to each other—then try and visualize ten rules of conduct that would be applicable in all these societies. An impossible task. Yet I'll bet that you have ten rules you want me to obey, and if one of them is wasted on an injunction against saying prayers to carved idols I can imagine just how universal the other nine are. You aren't being ethical if you try to apply them wherever you go—you're just finding a particularly fancy way to commit suicide!"

"You are being insulting!"

"I hope so. If I can't reach you in any other way, perhaps insult will jar you out of your state of moral smugness. How dare you even consider having me tried for stealing money from the Cassylia casino when all I was doing was conforming to their own code of ethics!

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They run crooked gambling games, so the law under their local ethos must be that crooked gambling is the norm. So I cheated them, conforming to their norm. If they have also passed a law that says cheating at gambling is illegal, the *law* is unethical, not the cheating. If you are bringing me back to be tried by that law you are unethical, and I am the helpless victim of an evil man."

"Limb of Satan!" Mikah shouted, leaping to his feet and pacing back and forth before Jason, clasping and unclasping his hands with agitation. "You seek to confuse me with your semantics and so-called ethics that are simply opportunism and greed. There is a Higher Law that cannot be argued—"

"That is an impossible statement—and I can prove it." Jason pointed at the books on the wall. "I can prove it with your own books, some of that light reading on the shelf there. Not the Aquinas—too thick. But the little volume with *Lull* on the spine. Is that Ramon Lull's 'The Booke of the Ordre of Chyualry'?"

Mikah's eyes widened. "You know the book? You're acquainted with Lull's writing?"

"Of course," Jason said, with an offhandedness he did not feel, since this was the only book in the collection he could remember reading, the odd title had stuck in his head. "Now let me see it and I shall prove to you what I mean." There was no way to tell from the unchanged naturalness of his words that this was the moment he had been working carefully towards. He sipped the tea. None of his tenseness showing.

Mikah Samon got the book and handed it to him. Jason flipped through the pages while he talked. "Yes . . . yes, this is perfect. An almost ideal example of your kind of thinking. Do you like to read Lull?"

"Inspirational!" Mikah answered, his eyes shining. "There is beauty in every line and Truths that we have forgotten in the rush of modern life. A reconciliation and proof of the interrelationship between the Mystical and the Concrete. By manipulation of symbols he explains everything by absolute logic."

"He proves nothing about nothing," Jason said emphatically. "He plays word games. He takes a word, gives it an abstract and unreal value, then proves this value by relating it to other words with the same sort of nebulous antecedents. His facts aren't facts—just meaningless sounds. This is the key point, where your universe and mine differ. You live in this world of meaningless facts that have no existence. My world contains facts that can be weighed, tested, proven related to other facts in a logical manner. My facts are unshakeable and unarguable. They exist."

"Show me one of your unshakeable facts," Mikah said, his voice calmer now than Jason's.

"Over there," Jason said. "The large green book over the console. It contains facts that even you will agree are true—I'll eat every page if you don't. Hand it to me." He sounded angry, making overly bold statements and Mikah fell right into the trap. He handed the volume to Jason, using both hands since it was very thick, metal bound and heavy.

"Now listen closely and try and understand, even if it is difficult for you," Jason said, opening the book. Mikah smiled wryly at this assumption of his ignorance. "This

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is a stellar ephemeris, just as packed with facts as an egg is with meat. In some ways it is a history of mankind. Now look at the jump screen there on the control console and you will see what I mean. Do you see the horizontal green line? Well, that's our course."

"Since this is my ship and I'm flying it I'm aware of that," Mikah said. "Get on with your proof."

"Bear with me," Jason told him. "I'll try and keep it simple. Now the red dot on the green line is our ship's position. The number above the screen our next navigational point, the spot where a star's gravitational field is strong enough to be detected in jump space. The number is the star's code listing. DB89-046-229. I'll look it up in the book"— he quickly flipped the pages—"and find its listing. No name. A row of code symbols though that tell a lot about it. This little symbol means that there is a planet or planets suitable for man to live on. Doesn't say if any people are there though."

"Where does this all lead to?" Mikah interrupted.

"Patience—you'll see in a moment. Now look, at the screen. The green dot approaching on the course line is the PMP. Point of Maximum Proximity. When the red dot and green dot coincide . . ."

"Give me that book," Mikah ordered, stepping forward. Aware suddenly that something was wrong. He was just an instant too late.

"Here's your proof." Jason said, and hurled the heavy book through the jump screen into the delicate circuits behind. Before it hit he had thrown the second book. There was a tinkling crash, a flare of light and the crackle of shorted circuits.

The floor gave a tremendous heave as the relays snapped open, dropping the ship through into normal space.

Mikah grunted in pain, clubbed to the floor by the suddenness of the transition. Locked into the chair, Jason fought the heaving of his stomach and the blackness before his eyes. As Mikah dragged himself to his feet, Jason took careful aim and sent the tray and dishes hurtling into the smoking ruin of the jump computer.

"There's your fact," he said in cheerful triumph. "Your incontrovertible, gold-plated, uranium-cored fact.

"We're not going to Cassylia any more!"

III

"You've killed us both," Mikah said with his face strained and white but his voice under control.

"Not quite," Jason told him cheerily. "But I have killed the jump control so we can't get to another star. However there's nothing wrong with our space drive, so we can make a landing on one of the planets—you saw for yourself that there is at least one suitable for habitation."

"Where I will fix the jump drive and continue the voyage to Cassylia. You will have gained nothing."

"Perhaps," Jason answered in his most noncommittal voice, since he did not have the slightest intention of continuing the trip, no matter what Mikah Samon thought.

His captor had reached the same conclusion. "Put your hand back on the chair arm," he ordered, and locked the cuff into place again. He stumbled as the

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drive started and the ship changed direction. "What was that?" he asked.

"Emergency control. The ship's computer knows that something drastic is wrong, so it has taken over. You can override it with the manuals, but don't bother yet. The ship can do a beter job than either of us with its senses and stored data. It will find the planet we're looking for, plot a course and get us there with the most economy of time and fuel. When we get into the atmosphere you can take over and look for a spot to set down."

"I don't believe a word you say now," Mikah said grimly. "I'm going to take control and get a call out on the emergency band. Someone will hear it." As he started forward the ship lurched again and all the lights went out. In the darkness flames could be seen flickering inside the controls. There was a hiss of foam and they vanished. With a weak flicker the emergency lighting circuit came on.

"Shouldn't have thrown the Ramon Lull book," Jason said. "The ship can't stomach it any more than I could."

"You are irreverent and profane," Mikah said through his clenched teeth, as he went to the controls. "You attempt to kill us both. You have no respect for your own life or mine. You're a man who deserves the worst punishment the law allows."

"I'm a gambler," Jason laughed. "Not at all as bad as you say. I take chances—but I only take them when the odds are right. You were carrying me back to certain death. The worst my wrecking the controls can do is administer the same end. So I took a chance. There is a bigger risk factor for you of course, but I'm afraid I didn't take that into consideration. After all, this entire affair is your idea. You'll just have to take the consequences of your own actions and not scold me for them."

"'You're perfectly right," Mikah said quietly. "I should have been more alert. Now will you tell me what to do to save *both* our lives. None of the controls work."

"None! Did you try the emergency override? The big red switch under the safety housing."

"I did. It is dead, too."

Jason slumped back into the seat. It was a moment before he could speak. "Read one of your books, Mikah," he said at last. "Seek consolation in your philosophy. There's nothing we can do. It's all up to the computer now, and whatever is left of the circuits."

"Can't we help—repair anything?"

"Are you a ship technician? I'm not. We would probably do more harm than good."

It took two ship-days of very erratic flight to reach the planet. A haze of clouds obscured the atmosphere. They approached from the night side and no details were visible. Or lights.

"If there were cities we should see their lights—shouldn't we?" Mikah asked.

"Not necessarily. Could be storms. Could be enclosed cities. Could be only ocean in this hemisphere."

"Or it could be that there are no people down there. Even if the ship should get us down safely—what will it matter? We will be trapped for the rest of our lives on this lost planet at the end of the universe."

"Don't be so cheerful," Jason interrupted. "How about taking off these cuffs while we go down. It will probably be a rough landing and I'd like to have some kind of a chance."

Mikah frowned at him. "Will you give me your word of honor that you won't try to escape during the landing?"

"No. And if I gave it—would you believe it? If you let me go, you take your chances. Let neither of us think it will be any different."

"I have my duty to do," Mikah said. Jason remained locked in the chair.

They were in the atmosphere, the gentle sighing against the hull quickly climbed the scale to a shrill scream. The drive cut out and they were in free fall. Air friction heated the outer hull white-hot and the interior temperature quickly rose in spite of the cooling unit.

"What's happening?" Mikah asked. "You seem to know more about this. Are we through—going to crash?"

"Maybe. Could be only one of two things. Either the whole works has folded up—in which case we are going to be scattered in very small pieces all over the landscape, or the computer is saving itself for one last effort. I hope that's it. They build computers smart these days, all sort of problem-solving circuits. The hull and engines are in good shape—but the controls spotty and unreliable. In a case like this a good human pilot would let the ship drop as far and fast as it could before switching on the drive. Then turn it on full—thirteen gees or more, whatever he figured the passengers could take on the couches. The hull would take a beating, but who cares. The control circuits would be used the shortest amount of time in the simplest manner."

"Do you think that's what happening?" Mikah asked, getting into his acceleration chair.

"That's what I *hope* is happening. Going to unlock the cuffs before you go to bed? It could be a bad landing and we might want to go places in a hurry."

Mikah considered, then took out his gun. "I'll unlock you, but I intend to shoot if you try anything. Once we are down you will be locked in again."

"Thanks for small blessings," Jason said, rubbing his wrists.

Deceleration jumped on them, kicked the air from their lungs in uncontrollable gasps, sank them deep into the yielding couches. Mikah's gun was pressed into his chest, too heavy to lift. It made no difference, Jason could not stand nor move. He hovered on the border of consciousness, his vision flickering behind a black and red haze.

Just as suddenly the pressure was gone.

They were still falling.

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The drive groaned in the stern of the ship and relays chattered. But it didn't start again. The two men stared at each other, unmoving, for the unmeasurable unit of time that the ship fell.

As the ship dropped it turned and hit at an angle. The end came for Jason in an engulfing wave of thunder, shock and pain. Sudden impact pushed him against the restraining straps, burst them with the inertia of his body, hurled him across the control room. His last conscious thought was to protect his head. He was lifting his arm when he struck the wall.

There is a cold that is so chilling it is a pain not a temperature. Cold that slices into the flesh before it numbs and kills.

Jason came to with the sound of his own voice crying hoarsely. The cold was so great it filled the universe. Cold water he realized as he coughed it from his mouth and nose. Something was around him and it took an effort to recognize it as Mikah's arm; he was holding Jason's face above the surface while he swam. A receding blackness in the water could only have been the ship, giving off bubbles and groans as it died. The cold water didn't hurt now and Jason was just relaxing when he felt something solid under his feet.

"Stand up and walk, curse you," Mikah gasped hoarsely. "I can't . . . carry you . . . can't carry myself . . ."

They floundered out of the water, side by side, four-legged crawling beasts that could not stand erect. Everything had an unreality to it and Jason found it hard to think. He should not stop, that he was sure of, but what else could he do? There was a flickering in the darkness, a wavering light coming towards them. Jason could say nothing, but he heard Mikah cry out for help.

Nearer came the light, some kind of a flare or torch, held high. Mikah pulled to his feet as the flame approached.

It was a nightmare. It wasn't a man but a thing that held the flare. A thing of angles, sharp corners, fang-faced and horrible. It had a clubbed extremity it used to strike down Mikah. The tall man fell wordlessly and the creature turned towards Jason. He had no strength to fight with, though he struggled to climb to his feet. His fingers scratched at the frosted sand, but he could not rise, and exhausted with this last effort he fell forward face down. Unconsciousness pulled at his brain but he would not submit. The flickering torchlight came closer and the scuffle of heavy feet in the sand; he could not have this horror behind him. With the last of his strength he levered himself over and lay on his back, staring up at the thing that stood over him, with the darkness of exhaustion filming his eyes.

IV

It did not kill him at once, but stood staring down at him, and as the slow seconds ticked by and Jason was still alive he forced himself to consider this menace that appeared from the blackness.

"*K'e vi stas el . . . ?*" The creature said, and for the first time Jason realized it was human. The meaning of the question picked at the edge of his exhausted brain, he felt he could almost understand it, though he had never heard the language before. He tried to answer but there was only a hoarse gargle from his throat.

"*Ven k'n torcoy—r'pidu!*"

More lights sprang from the darkness inland and with them the sound of running feet. As they came closer Jason had a clearer look at the man above him and could understand why he had mistaken him for some inhuman creature. His limbs were completely wrapped in lengths of stained leather, his chest and body protected by thick and overlapping leather plates covered with blood-red designs. Over his head was fitted the cochlea shaped shell of some animal, spiraling to a point in front: two small openings had been drilled in it for eye holes. Great, finger-long teeth had been set in the lower edge of the shell to heighten the already fearsome appearance. The only thing at all human about the creature was the matted and filthy beard that trickled out of the shell below the teeth. There were too many other details for Jason to absorb so suddenly; something bulky slung behind one shoulder, dark objects at the waist, a heavy club reached and prodded Jason in the ribs, but he was too close to unconsciousness to resist.

A guttural command halted the torch-bearers a full five meters from the spot where Jason lay. He wondered vaguely why the armored man had not let them approach closer since the light from their torches barely reached this far: everything on this planet seemed inexplicable. For a few moments Jason must have lost consciousness because when he looked again the torch was stuck in the sand at his side and the armored man had one of Jason's boots off and was pulling at the other. Jason could only writhe feebly but not prevent the theft, for some reason he could not force his body to follow his will. His sense of time seemed to have altered as well and though every second dragged heavily by events occurred with startling rapidity.

The boots were gone now and the man fumbled at Jason's clothes, stopping every few seconds to glance up at the row of torchbearers. The magnetic seals were alien to him, the sharp teeth sewn onto the leather over his knuckles dug into Jason's flesh as he struggled to open the seals or to tear the resistant metalcloth. He was growling with impatience when he accidentally touched the release button on the medikit and it dropped into his hand. This shining gadget seemed to please him, but when one of the sharp needles slipped through his thick handcoverings and stabbed him he howled with rage, throwing the machine down, and grinding it into a splintered ruin in the sand. The loss of this irreplaceable device goaded Jason into motion, he sat up and was

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trying to reach the medikit when unconsciousness surged over him.

Sometime before dawn the pain in his head drove him reluctantly back to awareness. There were some foul-smelling hides draped over him that retained a little of his body heat. He pulled away the stifling fold that covered his face and stared up at the stars, cold points of light that glittered in the frigid night. The air was a stimulant and he sucked in deep gasps of it that burned his throat but seemed to clear his thoughts. For the first time he realized that his disorientation had been caused by that crack on the head he had received when the ship crashed; his exploring fingers found a swollen rawness on his skull. He must have a brain concussion, that would explain his earlier inability to move or think straight. The cold air was numbing his face and he willingly pulled the hairy skin back over his head.

He wondered what had happened to Mikah Samon after the local thug in the horror outfit had bashed him with the club. This was a messy and unexpected end for the man after he had managed to survive the crash of the ship. Jason had no special affection for the undernourished zealot, but he did owe him a life. Mikah had saved him after the crash, only to be murdered himself by this local assassin. Jason made a mental note to kill the man just as soon as he was physically up to it, at the same time he was a little astonished at his reflexive acceptance of the need for this blood-thirsty atonement of a life for a life. Apparently his long stay on Pyrrus had trodden down his normal dislike for killing except in self-defense and from what he had seen so far of this world the Pyrran training would certainly be most useful. The sky showed gray through a tear in the hide and he pushed it back to look at the dawn.

Mikah Samon lay next to him his head projecting from a covering fur. His hair was matted and caked with dark blood, but he was still breathing.

"Harder to kill than I thought," Jason grunted as he levered himself painfully up onto one elbow and took a good look at this world where his spaceship sabotage had landed them.

It was a grim desert, lumped with huddled bodies like the aftermath of a battle at world's-end. A few of them were stumbling to their feet, holding their skins around them, the only signs of life in that immense waste of gritty sand. On one side a ridge of dunes cut off sight of the sea, but he could hear the dull boom of waves on the shore. White frost rimed the ground and the chill wind made his eyes blink and water. On the top of the dunes a remembered figure suddenly appeared, the armored man, doing something with what appeared to be lengths of rope; there was metallic tinkling, suddenly cut off. Mikah Samon groaned and stirred.

"How do you feel," Jason asked. "Those are two of the finest blood-shot eyeballs I have ever seen."

"Where am I?"

"Now that is a bright and original question—I didn't pick you for the type who watched historical spaceopera on the TV. I have no idea where we are—but I can give you a brief synopsis of how we arrived here, if you are up to it."

"I remember we swam ashore, then something evil came from the darkness, like a demon from hell. We fought . . ."

"And he bashed in your head, one quick blow and that was about all the fight there was. I had a better look at your demon, though I was in no better condition to fight him than you were. He's a man dressed in a weird outfit out of an addict's nightmare and appears to be the boss of this crew of rugged campers. Other than that I have little idea of what is going on—except that he stole my boots and I'm going to get them back if I have to kill him for them."

"Do not lust after material things," Mikah intoned seriously. "And do not talk of killing a man for material gain. You are evil, Jason, and . . . My boots are gone—and my clothes, too!"

Mikah had thrown back his covering skins and made this startling discovery. "Belial!" he roared. "Asmodeus, Abaddon, Apollyon and Baal-zebub!"

"Very nice," Jason said admiringly, "you really have been studying up on your demonology. Were you just listing them—or calling on them for aid?"

"Silence, blasphemer! I have been robbed!" He rose to his feet and the wind whistling around his almost-bare body quickly gave his skin a light touch of blue. "I am going to find the evil creature that did this and force him to return what is mine."

Mikah turned to leave but Jason reached out and grabbed his ankle with a wrestling grip, twisted it and brought the man thudding to the ground. The fall dazed him and Jason pulled the skins back over the raw-boned form.

"We're even," Jason said. "You saved my life last night, just now I saved yours. You're bare-handed and wounded—while the old man of the mountain up there is a walking armory, and anyone with the personality to wear that kind of an outfit will kill you as easily as he picks his teeth. So take it easy and try to avoid trouble. There's a way out of this mess—there's a way out of *every* mess if you look for it—and I'm going to find it. In fact I'm going to take a walk right now and start my research. Agreed?"

A groan was his only answer since Mikah was unconscious again, fresh blood seeping from his injured scalp. Jason stood and wrapped his hides about his body as some protection from the wind, tying the loose ends together. Then he kicked through the sand until he found a smooth rock that would fit inside his fist with just the end protruding, and thus armed made his way out through the stirring forms of the sleepers.

Mikah was conscious again when Jason returned, and

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the sun was well above the horizon. The people were all awake now, a shuffling, scratching herd of about thirty men, women and children. They were identical in their filth and crude skin wrappings, milling about with a random motion or sitting blankly on the ground. They showed no interest at all in the two strangers. Jason handed a tarred leather cup to Mikah and squatted next to him.

"Drink that. It's water, the only thing that anyone here had to drink. I didn't find any food." He still had the stone in his hand and while he talked he rubbed it on the sand: the end was moist and red and some long hairs were stuck in it.

"I took a good look around this camp, and there's very little more than you can see from here. Just this crowd of broken down types, a few bundles rolled in hide, and some of them are carrying skin water bottles. They have a simple me-stronger pecking order so I pecked a bit and we can drink. Food comes next."

"Who are they? What are we doing?" Mikah asked, mumbling a little, obviously still suffering the aftereffects of the blow. Jason looked at the contused skull, and decided not to touch it. The wound had bled freely and clotted. Washing it off with the highly dubious water would accomplish little and might add infection to their other troubles.

"I'm only sure of one thing," Jason said. "They're slaves. I don't know why they are here, what they are doing or where they are going, but their status is painfully clear—ours, too. Old Nasty up there on the hill is the boss. The rest of us are slaves."

"Slaves!" Mikah snorted, the word penetrating through the pain in his head. "It is abominable. The slaves must be freed."

"No lectures please, and try to be realistic—even if it hurts. There are only two slaves that need freeing here, you and I. These people seem nicely adjusted to the *status quo* and I see no reason to change it. I'm not starting any abolitionist campaigns until I can see my way clearly out of this mess, and I probably won't start any then either. This planet has been going on a long time without me, and will probably keep rolling along once I'm gone."

"Coward! You must fight for the Truth and the Truth will make you free."

"I can hear those capital letters again," Jason groaned. "The only thing right now that is going to make me free is me. Which may be bad poetry, but is still the truth. The situation here is rough but not unbeatable—so listen and learn. The boss, his name is Ch'aka in case you care, seems to have gone off on a hunt of some kind. He's not far away and will be back soon, so I'll try and give you the entire setup quickly.

"I thought I recognized the language, and I was right. It's a corrupt form of Esperanto, the language all the Terido worlds speak. This altered language plus the fact that these people live about one step above the stone-age culture is pretty sure evidence that they are cut off from any contact with the rest of the galaxy, though I hope not. There may be a trading base somewhere on the planet, and if there is we'll find it later. We have enough other things to worry about right now, but at least we can speak the language. These people have contracted and lost a lot of sounds and even introduced a glottal stop, something that *no* language needs, but with a little effort the meaning can still be made out."

"I do not speak Esperanto."

"Then learn it. It's easy enough even in this jumbled form. And shut up and listen. These locals are born and bred slaves and it is all they know. There is a little squabbling in the ranks with the bigger ones pushing the work on the weak ones when Ch'aka isn't looking, but I have that situation well in hand. Ch'aka is our big problem, and we have to find out a lot more things before we can tackle him. He is boss, fighter, father, provider and destiny for this mob, and he seems to know his job. So try to be a good slave for a while . . ."

"Slave! I?" Mikah arched his back and tried to rise. Jason pushed him back to the ground—harder than was necessary.

"Yes, you—and me, too. That is the only way we are going to survive in this arrangement. Do what everyone else does, obey orders, and you stand a good chance of staying alive until we can find a way out of this tangle."

Mikah's answer was drowned out in a roar from the dunes as Ch'aka returned. The slaves climbed quickly to their feet, grabbing up their bundles, and began to form a single widespaced line. Jason helped Mikah to stand and wrap strips of skin around his feet then supported most of his weight as they stumbled to a place in the open formation. Once they were all in position Ch'aka kicked the nearest one and they began walking slowly forward looking carefully at the ground as they went. Jason had no idea of the significance of the action, but as long as he and Mikah weren't bothered it didn't matter: he had enough work cut out for him just to keep the wounded man on his feet. Somehow Mikah managed to dredge up enough strength to keep going.

One of the slaves pointed down and shouted and the line stopped. He was too far away for Jason to make out the cause of the excitement, but the man bent over and scratched a hole with a short length of pointed wood. In a few seconds he dug up something round and not quite the size of his hand. He raised it over his head and brought the thing to Ch'aka at a shambling run. The slavemaster took it and bit off a chunk, and when the man who had found it turned away he gave him a lusty kick. The line moved forward again.

Two more of the mysterious objects were found, both of which Ch'aka ate as well. Only when his immediate hunger was satisfied did he make any attempt to be the good provider. When the next one was found he called over a slave and threw the object into a crudely woven

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basket he was carrying on his back. After this the basket-toting slave walked directly in front of Ch'aka who was carefully watchful that every one of the things that was dug up went into the basket. Jason wondered what they were—and they were edible, too, an angry rumbling in his stomach reminded him.

The slave next in line to Jason shouted and pointed to the sand. Jason let Mikah sink to a sitting position when they stopped and watched with interest as the slave attacked the ground with his piece of wood, scratching around a tiny sprig of green that projected from the desert sand. His burrowings uncovered a wrinkled gray object from which the green leaves were growing, a root or tuber of some kind. It appeared as edible as a piece of stone to Jason, but obviously not to the slave who drooled heavily and actually had the temerity to sniff the root. Ch'aka howled with anger at this and when the slave had dropped the root into the basket with the others he received a kick so strong that he had to limp back painfully to his position in the line.

Soon after this Ch'aka called a halt and the tattered slaves huddled around while he poked through the basket. He called them over one at a time and gave them one or more of the roots according to some merit system of his own. The basket was almost empty when he poked his club at Jason.

"K'e nam h'vas vi?" he asked.

"Mia namo estas Jason, mia amiko estas Mikah."

Jason answered in correct Esperanto that Ch'aka seemed to understand well enough, because he grunted and dug through the contents of the basket. His masked face stared at them and Jason could feel the impact of the unseen watching eyes. The club pointed again.

"Where you come from? That you ship that burn, sink?"

"That was our ship. We come from far away."

"From other side of ocean?" This was apparently the largest distance the slaver could imagine.

"From the other side of the ocean, correct." Jason was in no mood to deliver a lecture on astronomy. "When do we eat?"

"You a rich man in your country, got a ship, got shoes. Now I got your shoes. You a slave here. My slave. You both my slaves."

"I'm your slave, I'm your slave," Jason said resignedly. "But even slaves have to eat. Where's the food?"

Ch'aka grubbed around in the basket until he found a tiny and withered root which he broke in half and threw onto the sand in front of Jason.

"Work hard you get more."

Jason picked up the pieces and brushed away as much of the dirt as he could. He handed one to Mikah and took a tentative bite out of the other one: it was gritty with sand and tasted like slightly rancid wax. It took a distinct effort to eat the repulsive thing but he did. Without a doubt it was food, no matter how unwholesome, and would do until something better came along.

"What did you talk about?" Mikah asked, grinding his own portion between his teeth.

"Just swapping lies. He thinks we're his slaves and I agreed. But it's just temporary—" Jason added as anger colored Mikah's face and he started to climb to his feet. Jason pulled him back down. "This is a strange planet, you're injured, we have no food or water, and no idea at all how to survive in this place. The only thing we can do to stay alive is to go along with what Old Ugly there says. If he wants to call us slaves, fine—we're slaves."

"Better to die free than to live in chains!"

"Will you stop the nonsense. Better to live in chains and learn how to get rid of them. That way you end up alive-free rather than dead-free, a much more attractive state. Now shut up and eat. We can't do anything until you are out of the walking wounded class."

For the rest of the day the line of walkers plodded across the sand and in addition to helping Mikah, Jason found two of the *krenoj*, the edible roots. They stopped before dusk and dropped gratefully to the sand. When the food was divided they received a slightly larger portion, as evidence perhaps of Jason's attention to the work. Both men were exhausted and fell asleep as soon as it was dark.

During the following morning they had their first break from the walking routine. Their foodsearching always paralleled the unseen sea, and one slave walked the crest of the dunes that hid the water from sight. He must have seen something of interest because he leaped down from the mound and waved both arms wildly. Ch'aka ran heavily to the dunes and talked with the scout, then booted the man from his presence.

Jason watched with growing interest as he unwrapped the bulky package slung from his back and disclosed an efficient looking crossbow, cocking it by winding on a built-in crank. This complicated and deadly piece of machinery seemed very much out of place with the primitive slave-holding society, and Jason wished that he could get a better look at the device. Ch'aka fumbled a quarrel from another pouch and fitted it to the bow. The slaves sat silently on the sand while their master stalked along the base of the dunes, then wormed his way over them and out of sight, creeping silently on his stomach. A few minutes later there was a scream of pain from behind the dunes and all the slaves jumped to their feet and raced to see. Jason left Mikah where he lay and was in the first rank of observers that broke over the hillocks and onto the shore.

They stopped at the usual distance and shouted compliments about the quality of the shot and what a mighty hunter Ch'aka was. Jason had to admit there was a certain truth in the claims. A large, furred amphibian lay at the water's edge, the fletched end of the crossbow bolt projecting from its thick neck and a thin stream of blood running down to mix with the surging waves.

"Meat! Meat today!"

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"Ch'aka kills the *rosmaro!* Ch'aka is wonderful!"

"Hail, Ch'aka, great provider," Jason shouted to get into the swing of things. "When do we eat?"

The master ignored his slaves, sitting heavily on the dune until he regained his breath after the stalk. Then after cocking the crossbow again he stalked over to the beast and with his knife cut out the quarrel, notching it against the bowstring still dripping with blood.

"Get wood for fire," he commanded. "You Opisweni, you use the knife."

Shuffling backwards Ch'aka sat down on a hillock and pointed the crossbow at the slave who approached the kill. Ch'aka had left his knife in the animal and Opisweni pulled it free and began to methodically flay and butcher the beast. All the time he worked he carefully kept his back turned to Ch'aka and the aimed bow.

"A trusting soul, our slave-driver," Jason mumbled to himself as he joined the others in searching the shore for driftwood. Ch'aka had all the weapons as well as a constant fear of assasination. If Opisweni tried to use the knife for anything other than the intended piece of work, he would get the crossbow quarrel in the back of his head. Very efficient.

Enough driftwood was found to make a sizable fire, and when Jason returned with his contribution the *rosmaro* had been hacked into large chunks. Ch'aka kicked his slaves away from the heap of wood and produced a small device from another of his sacks. Interested, Jason pushed as close as he dared, into the front rank of the watching circle. Though he had never seen one of them before, the operation of the firemaker was obvious to him. A spring-loaded arm drove a fragment of stone against a piece of steel, sparks flew out and were caught in a cup of tinder, where Ch'aka blew on them until they burst into flame.

Where had the firelighter and the crossbow come from? They were evidence of a higher level of culture than that possessed by these slave-holding nomads. This was the first bit of evidence that Jason had seen that there might be more to the cultural life of this planet than they had seen since their landing. Later, while they were gorging themselves on the seared meat, he drew Mikah aside and pointed this out.

"There's hope yet. These illiterate thugs never manufactured that crossbow or firelighter. We must find out where they came from and see about getting there ourselves. I had a look at the quarrel when Ch'aka pulled it out, and I'll swear that it was turned from steel."

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"This has significance?" Mikah asked, puzzled.

"It means an industrial society, and possible interstellar contact."

"Then we must ask Ch'aka where he obtained them and leave at once. There will be authorities, we will contact them, explain the situation, obtain transportation to Cassylia. I will not place you under arrest again until that time."

"How considerate of you," Jason said, lifting one eyebrow. Mikah was absolutely impossible, and Jason probed at his moral armor to see if there were any weak spots. "Won't you feel guilty about bringing me back to get killed? After all we are companions in trouble—and I did save your life."

"I will grieve, Jason. I can see that though you are evil you are not completely evil, and given the right training could be fitted for a useful place in society. But my personal grief must not be allowed to alter events: you forget that you committed a crime and must pay the penalty."

Ch'aka belched cavernously inside his shell-helmet and howled at his slaves.

"Enough eating, you pigs. You get fat. Wrap the meat and carry it, we have light yet to look for *krenoj*. Move!"

Once more the line was formed and began its slow pace across the desert. More of the edible roots were found, and once they stopped briefly to fill the water bags at a spring that bubbled up out of the sand. The sun dropped towards the horizon and what little warmth it possessed was absorbed by a bank of clouds. Jason looked around and shivered—then noticed the line of dots moving on the horizon. He nudged Mikah who still leaned heavily on him.

"Looks like company coming. I wonder where they fit into the program?"

Pain had blurred Mikah's attention and he took no notice and, surprisingly enough, neither did any of the other slaves nor Ch'aka. The dots expanded and became another row of marchers, apparently absorbed in the same task as Jason's group. They plodded forward, making a slow examination of the sand, followed behind by the solitary figure of their master. The two lines slowly approached each other, paralleling the shore.

Near the dunes was a crude mound of stones and the line of walking slaves stopped as soon as they reached it, dropping with satisfied grunts onto the sand. The cairn was obviously a border marker and Ch'aka walked to it and rested his foot on one of the stones, watching while the other line of slaves approached. They, too, stopped at the cairn and settled to the ground: both groups stared with dull-eyed lack of interest and only the slave-masters showed any animation. The other master stopped a good ten paces before he reached Ch'aka and waved an evil looking stone hammer over his head.

"Hate you, Ch'aka!" he roared.

"Hate you, Fasimba!" boomed back the answer.

The exchange was as formal as a *pas de deux* and just about as warlike. Both men shook their weapons and shouted a few insults, then settled down to a quiet conversation. Fasimba was garbed in the same type of hideous and fear-inspiring outfit as Ch'aka, differing only in unimportant details. Instead of a conch, his head was encased in the skull of one of the amphibious *rosmaroj*, brightened up with some extra tusks and horns. The differences between the two men were all minor, and mostly a matter of decoration or variation of weapon design. They were obviously slave masters and equals.

"Killed a *rosmaro* today, second time in ten days," Ch'aka said.

"You got a good piece coast. Plenty *rosmaroj*. Where the two slaves you owe me?"

"I owe you two slaves?"

"You owe me two slaves, don't play like stupid. I got the iron arrows for you from the *d'zertanoj*, one slave you paid with died. You still owe other one."

"I got two slaves for you. I got two slaves more I pulled out of the ocean."

"You got a good piece coast."

Ch'aka walked down his line of slaves until he came to the over-bold one he had half-crippled with a kick the day before. Pulling him to his feet he booted him towards the other mob.

"Here a good one," he said, delivering the goods with a last parting kick.

"Look skinny. Not too good."

"No, all muscles. Works hard. Doesn't eat much."

"You're a liar!"

"Hate you, Fasimba!"

"Hate you, Ch'aka! Where's the other one?"

"Got a good one. Stranger from the ocean. He can tell you funny stories, work hard."

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Jason turned in time to avoid the full force of the kick, but it was still strong enough to knock him sprawling. Before he could get up Ch'aka had clutched Mikah Samon by the arm and dragged him across the invisible line to the other group of slaves. Fasimba stalked over to examine him, prodding him with a spiked toe.

"Don't look good. Big hole on the head."

"He works hard," Ch'aka said. "Hole almost healed. He very strong."

"You give me new one if he dies?" Fasimba asked doubtfully.

"I'll give you. Hate you, Fasimba!"

"Hate *you*, Ch'aka!"

The slave herds were prodded to their feet and moved back the way they had come, and Jason shouted after Ch'aka.

"Wait! Don't sell my friend. We work better together, you can get rid of someone else . . ."

The slaves gaped at this sudden outburst and Ch'aka wheeled raising his club.

"You shut up. You're a slave. You tell me once more to do what and I kill you."

Jason shut up since it was very obvious that this was the only thing he could do. He had a few qualms about Mikah's possible fate: if he survived the wound he was certainly not the type to bow to the inevitabilities of slave-holding life. Yet Jason had done his best to save him and that was that. Now Jason would think about Jason for a while.

They made a brief march before dark, apparently just until the other slaves were out of sight, then stopped for the night. Jason settled himself into the lee of a mound that broke the force of the wind a bit and unwrapped a piece of scorched meat he had salvaged from the earlier feast. It was tough and oily but far superior to the barely edible *krenoj* that made up the greater part of the native diet. He chewed noisily on the bone and watched while one of the other slaves sidled over towards him.

"Give me some your meat?" the slave asked in a whining voice, and only when she talked did Jason realize that this was a girl; all the slaves were alike in their matted hair and skin wrappings. He ripped off a chunk of meat.

"Here. Sit down and eat it. What's your name?" In exchange for his generosity he intended to get some information from his captive audience.

"Ijale." She tore at the meat, held tightly in one fist, while the index finger of her free hand scratched for enemies in her tangled hair.

"Where do you come from? Did you always live here —like this?" How do you ask a slave if she has always been a slave?

"Not here. I come from Bul'wajo first, then Fasimba, now I belong to Ch'aka."

"What or who is Bul'wajo? Someone like our boss Ch'aka?" She nodded, gnawing at the meat. "And the *d'zertanoj* that Fasimba gets his arrows from—who are they?"

"You don't know much," she said, finishing the meat and licking the grease from her fingers.

"I know enough to have meat when you don't have any—so don't abuse my hospitality. Who are the *d'zertanoj?*"

"Everyone knows who they are." She shrugged with incomprehension and looked for a soft spot in the sand to sit down. "They live in the desert. They go around in *caroj*. They stink. They have many nice things. One of them gave me my best thing. If I show it to you, you won't take it?"

"No, I won't touch it. But I would like to see anything they have made. Here, here's some more meat. Now let me see your best thing."

Ijale rooted in her skins for a hidden pocket and dragged out something that she concealed in her clenched fist. She held it out proudly and opened it and there was enough light left for Jason to make out the rough form of a red glass bead.

"Isn't this so very nice?" she asked.

"Very nice," Jason agreed, and for an instant felt a touch of real sorrow when he looked at the pathetic bauble. This girl's ancestors had come to this planet in spaceships with a knowledge of the most advanced sciences. Cut off, their children had degenerated into this, barely conscious slaves, who could pride a worthless piece of glass above all things.

"I like you. I'll show you my best thing again."

"I like you, too. Good night.

V

Ijale stayed near Jason the next day, and took the next station in line when the endless *krenoj* hunt began. Whenever it was possible he questioned her and before noon had extracted all of her meager knowledge of affairs beyond the barren coastal plain where they lived. The ocean was a mystery that produced edible animals, fish and an occasional human corpse. Ships could be seen from time to time offshore but nothing was known about them. On the other flank the territory was bounded by desert even more inhospitable than the one in which they scratched out their existence, a waste of lifeless sand, habitable only by the *d'zertanoj* and their mysterious *caroj*. These last could be animals—or mechanical transportation of some kind, either was possible from Ijale's vague description. Ocean, coast and desert, these made up all of her world and she could conceive of nothing that might exist beyond.

Jason knew there was more, the crossbow was proof enough of that, and he had every intention of finding out where it came from. In order to do that he was going to have to change his slave status when the proper

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time came. He was developing a certain facility in dodging Ch'aka's heavy boot, the work was never hard and there was ample food. Being a slave left him with no responsibilities other than obeying orders and he had ample opportunity to discover what he could about this planet, so that when he finally did leave he would be as well prepared as was possible.

Later in the day another column of marching slaves was sighted in the distance, on a course paralleling their own, and Jason expected a repeat performance of the previous day's meeting. He was agreeably surprised that it was not. The sight of the others threw Ch'aka into an immediate rage that sent his slaves rushing for safety in all directions. By leaping into the air, howling with anger and beating his club against his thick leather armor he managed to work himself into quite a state before starting off on a slogging run. Jason, followed close behind him, greatly interested by this new turn of affairs. Ahead of them the other slaves scattered and from their midst burst another armed and armored figure. They churned towards each other at top speed and Jason hoped for a shattering crash when they met. However they slowed before they hit and began circling each other, spitting curses.

"Hate you, M'shika!"

"Hate you, Ch'aka!"

The words were the same, but shouted with fierce meaning, with no touch of formality this time.

"Kill you, M'shika! You coming again on my part of the ground with your carrion-meat slaves!"

"You lie, Ch'aka—this ground mine from way back."

"I kill you way back!"

Ch'aka leaped in as he screamed the words and swung a roundhouse blow with his club that would have broken the other man in two if it had connected. But M'shika was expecting this and fell back, swinging a counterblow with his own club that Ch'aka easily avoided. There followed a quick exchange of club-work that did little more than fan the air, until suddenly both men were locked together and the fight began in earnest. They rolled together on the ground grunting savagely, tearing at each other. The heavy clubs were of no use this close and were dropped in favor of knives and knees: Jason could understand now why Ch'aka had the long tusks strapped to his kneecaps. It was a no-holds-barred fight and each man was trying as hard as possible to kill his opponent. The leather armor made this difficult and the struggle continued, littering the sand with broken off animal teeth, discarded weapons and other debris. It looked like it would be called a draw when both men separated for a breather, but they dived right back in again.

It was Ch'aka who broke the stalemate when he plunged his dagger into the ground and on the next roll caught the handle in his mouth. Holding his opponent's arms in both his hands he plunged his head down and managed to find a weak spot in the other's armor: M'shika howled and pulled free and when he climbed to his feet blood was running down his arm and dripping from his fingertips. Ch'aka jumped after him but the wounded man grabbed up his club in time to ward off the charge. Stumbling backward he managed to pick up most of his discarded weapons with his wounded arm and beat a hasty retreat. Ch'aka ran after him a short way, shouting praise of his own strength and abilities and of his opponent's cowardice. Jason saw a short, sharp horn from some sea animal lying in the churned up sand and quickly picked it up before Ch'aka turned back.

Once his enemy had been chased out of sight Ch'aka carefully searched the battleground and scavenged anything of military value. Though there was still some hours of daylight left he signaled a halt and distributed the evening ration of *krenoj*. Jason sat and chewed his portion reflectively while Ijale leaned against his side, her shoulder moving rhythmically as she scratched some hidden mite. Lice were inescapable, they hid in the crevices of the badly cured hides and emerged with clicking jaws whenever the warmth of human flesh came near. Jason had his quota of the pests and found his scratching keeping time with hers. This syncopation of scratch triggered the anger that had been building within him, slow and unnoticed.

"I'm serving notice," he said, jumping to his feet. "I'm through with this slave business. Which way is the nearest spot in the desert where I can find the *d'zertanoj?*"

"Over there, a two-day walk. How are you going to kill Ch'aka?"

"I'm not going to kill Ch'aka, I'm just leaving. I've enjoyed his hospitality and his boot long enough and feel like striking out for myself."

"You can't do that," she gasped. "You will be killed."

"Ch'aka can't very well kill me if I'm not here."

"Everybody will kill you. That is the law. Runaway slaves are always killed."

Jason sat down again and cracked another chunk from his *kreno* and ruminated over it. "You've talked me into staying a while. But I have no particular desire now to kill Ch'aka, even though he did steal my boots. And I don't see how killing him will help me any."

"You are stupid. After you kill Ch'aka you'll be the new Ch'aka. Then you can do what you want."

Of course. Now that he had been told, the social setup appeared obvious. Because he had seen slaves and slaveholders, Jason had held the mistaken notion that they were different classes of society, when in reality there was only one class, what might be called the dog-eat-dog class. He should have been aware of this when he had seen how careful Ch'aka was to never allow anyone within striking distance of him, and how he vanished each night to some hidden spot. This was free enterprise with a vengeance, carried to its absolute extreme with every man out for himself, every other man's hand

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turned against him, and your station in life determined by the strength of your arm and the speed of your reflexes. Anyone who stayed alone placed himself outside this society and was therefore an enemy of it and sure to be killed on sight. All of which added up to the fact that he had to kill Ch'aka if he wanted to get ahead. He still had no desire to do it, but he had to.

That night he watched Ch'aka when he slipped away from the others and Jason made a careful note of the direction that he took. Of course the slave master would circle about before he concealed himself, but with a little luck Jason would find him. And kill him. He had no special love of midnight assassination, and until landing on this planet had always believed that killing a sleeping man was a cowardly way to terminate another's existence. But special conditions demand special solutions, and he was no match for the heavily armored man in open combat, therefore the assassin's knife. Or rather sharpened horn. He managed to doze fitfully until some time after midnight, then slipped silently from under his skin coverings. Silently he skirted the sleepers and crept into the darkness between the dunes.

Finding Ch'aka in the wilderness of the desert night was not easy, yet Jason persisted. He made careful sweeps in wider and wider arcs, working his way out from the sleeping slaves. There were gullies and shadowed ravines and all of them had to be searched with utmost care. The slave master was sleeping in one of them and would be alert for any sound. The fact that he had also made special precautions to guard against assassination was only apparent to Jason after he heard the bell ring. It was a tiny sound, barely detectable, but he froze instantly. There was a thin strand pressing against his arm, and when he drew back carefully the bell sounded again. He cursed silently for his stupidity, only remembering now about the bells he had heard from Ch'aka's sleeping site. The slaver must surround himself every night with a network of string that would sound alarm bells if anyone attempted to approach in the dark. Slowly and soundlessly Jason drew back deeper into the gully.

With a thud of rushing feet Ch'aka appeared, swinging his club around his head, coming directly towards Jason. Jason rolled desperately sideways and the club crashed into the ground, then he was up and running at top speed down the gully. Rocks twisted under his feet and he knew that if he tripped he was dead, yet he had no choice other than flight. The heavily armored Ch'aka could not keep up with him and Jason managed to stay on his feet until the other was left behind. Ch'aka shouted with rage and hurled curses after him, but he could not catch him. Jason, panting for breath, vanished into the darkness and made a slow circle back to the sleeping camp. The noise would have roused them and he stayed away for an estimated hour, shivering in the icy predawn, before he slipped back to his waiting skins. The sky was beginning to gray and he lay awake wondering if he had been recognized: he didn't think he had.

As the red sun climbed above the horizon Ch'aka appeared on top of the dunes, shaking with rage.

"Who did it?" he screamed. "Who came in night." He stalked among them, glaring right and left, and no one stirred except to draw away from his stamping feet. "Who did it?" he shouted again as he came near the spot where Jason lay.

Five slaves pointed silently at Jason.

Cursing their betrayal Jason sprang up and ran from the whistling club. He had the sharpened horn in his hand but knew better than to try and stand up to Ch'aka in open combat; there had to be another way. He looked back quickly to see his enemy still following and narrowly missed tripping over the outstretched leg of a slave. They were all against him! They were all against each other and no man was safe from any other man's hand. He ran free of the slaves and scrambled to the top of a shifting dune, pulling himself up the steep slope by clutching at the coarse grass on the summit. He turned at the top and kicked sand into Ch'aka's face, trying to blind him, but had to run when the slaver swung down his crossbow and notched a steel quarrel. Ch'aka chased him again, panting heavily.

Jason was tiring now and he knew this was the best time to launch a counterattack. The slaves were out of sight and it would be a battle only between the two of them. Scrambling up a slope of broken rock he reversed himself suddenly and leaped back down. Ch'aka was taken by surprise and had his club only half-raised when Jason was upon him, and he swung wildly. Jason ducked under the blow and used Ch'aka's momentum to help throw him as he grabbed the club arm and pulled. Face down the armored man crashed against the stones and Jason was straddling his back even as he fell, clutching for his chin. He lacerated his fingers on a jagged tooth necklace then grasped the man's thick beard and pulled back. For a single long instant, before he could writhe free and roll over, Ch'aka s head was stretched back, and in that instant Jason plunged the sharp horn deep into the soft flesh of the throat. Hot blood burst over his hand and Ch'aka shuddered horribly under him and died.

Jason climbed wearily to his feet, suddenly exhausted. He was alone with his victim. The cold wind swept about them carrying the rustling grains of sand, chilling the sweat on his body. Sighing once he wiped his bloody hands on the sand and began to strip the corpse. Thick straps held the shell helmet over the dead man's head and when he unknotted them and pulled it away he saw that Ch'aka was well past middle age. There was some gray in his beard, but his scraggly hair was completely gray, his face and balding head pallid white from being concealed under the helmet. It took a long time to get

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the wrappings and armor off and retie them over himself, but it was finally done. Under the skin and claw wrappings on Ch'aka's feet were Jason's boots, filthy but undamaged, and Jason drew them on happily. When at last, after scouring it out with sand, he had strapped on the helmet, Ch'aka was reborn. The corpse on the sand was just another dead slave. Jason scraped a shallow grave, interred and covered it. Then, slung about with weapons, bags and crossbow, the club in his hand, he stalked back to the waiting slaves. As soon as he appeared they scrambled to their feet and formed a line. Jason saw Ijale looking at him worriedly, trying to discover who had won the battle.

"Score one for the visiting team," he called out, and she gave him a small, frightened smile and turned away. "About face all and head back the way we came. There is a new day dawning for you slaves. I know you don't believe this yet, but there are some big changes in store."

He whistled while he strolled after the line and chewed happily on the first *krenoj* that was found.

VI

That evening they built a fire on the beach and Jason sat with his back to the safety of the sea. He took his helmet off, the thing was giving him a headache, and called Ijale over to him.

"I hear Ch'aka. I obey."

She ran hurriedly to him and flopped onto the sand.

"I want to talk to you," Jason said. "And my name is Jason, not Ch'aka."

"Yes, Ch'aka," she said, darting a quick glance at his exposed face, then turning away. He grumbled and pushed the basket of *krenoj* over to her.

"I can see where it is not going to be an easy thing changing this social setup. Tell me, do you or any of the others ever have any desire to be free?"

"What is free?"

"Well . . . I suppose that answers my question. Free is what you are when you are not a slave, or a slave owner, free to go where you want and do what you want."

"I wouldn't like that." She shivered. "Who would take care of me? How could I find any *krenoj?* It takes many people together to find *krenoj,* one alone would starve."

"If you are free, you can combine with other free people and look for *krenoj* together."

"That is stupid. Whoever found would eat and not share unless a master made him. I like to eat."

Jason rasped his sprouting beard. "We all like to eat, but that doesn't mean we have to be slaves. But I can see that unless there are some radical changes in this environment I am not going to have much luck in freeing anyone, and I had better take all the precautions of a Ch'aka to see that I can stay alive."

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He picked up his club and stalked off into the darkness, silently circling the camp until he found a good-sized knoll with smooth sides. Working by touch he pulled the little pegs from their bag and planted them in rows, carefully laying the leather strings in their forked tops. The ends of the strings were fastened to delicately balanced steel bells that tinkled at the slightest touch. Thus protected he lay down in the center of his warning spiderweb and spent a restless night, half awake, waiting tensely for the bells to ring.

In the morning the march continued and they came to the barrier cairn, and when the slaves stopped Jason urged them past it. They did this happily, looking forward to witnessing a good fight for possession of the violated territory. Their hopes were justified when later in the day the other row of slaves was seen far off to the right, and a figure detached itself and ran towards them.

"Hate you, Ch'aka!" Fasimba shouted as he ran up, only this time he meant what he said. "Coming on my ground, I kill you!"

"Not yet," Jason called out. "And hate you, Fasimba, sorry I forgot the formalities. I don't want any of your land and the old treaty or whatever it is still holds. I just want to talk to you."

Fasimba stopped, but kept his stone hammer ready, very suspicious. "You got new voice, Ch'aka."

"I got new Ch'aka, old Ch'aka now pushing up the daisies. I want to trade back a slave from you and then we'll go."

"Ch'aka fight hard. You must be good fighter Ch'aka." He shook his hammer angrily. "Not as good as me, Ch'aka!"

"You're the tops, Fasimba, nine slaves out of ten want you for a master. Look, can't we get to the point, then I'll get my mob out of here." He looked at the row of approaching slaves, trying to pick out Mikah. "I want back the slave who had the hole in his head. I'll give you two slaves in trade, your choice. What do you say to that?"

"Good trade, Ch'aka. You pick one of mine, take the best, I'll take two of yours. But hole-in-head gone. Too much trouble. Talk all the time. I got sore foot from kicking him. Got rid of him."

"Did you kill him?"

"Don't waste slave. Traded him to the *d'zertanoj*. Got arrows. You want arrows?"

"Not this time, Fasimba, but thanks for the information." He rooted around in a pouch and pulled out a *kreno*. "Here, have something to eat."

"Where you get poisoned *kreno?*" Fasimba asked with interest. "I could use a poisoned *kreno*."

"This isn't poisoned, it's perfectly edible, or at least as edible as these things ever are."

Fasimba laughed. "You pretty funny, Ch'aka. I give you one arrow for poisoned *kreno*."

"You're on," Jason said throwing the *kreno* to the ground between them. "But I tell you it is perfectly good."

"That's what I tell man I give it to. I got good use for a poisoned *kreno*." He threw an arrow into the sand away from them and grabbed up the vegetable as he left.

When Jason picked up the arrow it bent, and he saw that it was rusted almost completely in two and that the break had been craftily covered by clay. "That's all right," he called after the retreating slaver, "just wait until your friend eats the *kreno*."

The march continued, first back to the boundary cairn with the suspicious Fasimba dogging their steps. Only after Jason and his band had passed the border did the others return to their normal foraging. Then began the long walk to the borders of the inland desert. Since they had to search for *krenoj* as they went it took them the better part of three days to reach their destination. Jason merely started the line in the correct direction, but as soon as he was out of sight of the sea he had only a rough idea of the correct course, however he did not confide his ignorance to the slaves and they marched steadily on, along what was obviously a well-known route to them. Along the way they collected and consumed a good number of *krenoj*, found two wells from which they refilled the skin bags, and pointed out a huddled animal sitting by a hole that Jason, to their unvoiced disgust, managed to miss completely with a bolt from the crossbow.

On the morning of the third day Jason saw a line of demarcation on the flattened horizon and before the midday meal they came to a sea of billowing, bluish-gray sand. The ending of what he had been accustomed to thinking of as the desert was startling. Beneath their feet were yellow sand and gravel, while occasional shrubs managed a sickly existence as did some grass and the life-giving *krenoj*. Animals as well as men lived here and, ruthless though survival was, they were at least alive. In the wastes ahead no life was possible or visible, though there seemed to be no doubt that the *d'zertanoj* lived there. This must mean that though it looked unlimited—as Ijale believed it to be—there were probably arable lands on the other side. Mountains as well, if they weren't just clouds, since a line of gray peaks could just be made out on the distant horizon.

"Where do we find the *d'zertanoj?*" he asked the nearest slave who merely scowled and looked away. Jason was having a problem with discipline. The slaves would not do a thing he asked unless he kicked them. Their conditioning had been so thorough that an order unaccompanied by a kick just wasn't an order and his continued reluctance to impose the physical coercion with the spoken command was just being taken as a sign of weakness. Already some of the burlier slaves were licking their lips and sizing him up. His efforts to im-

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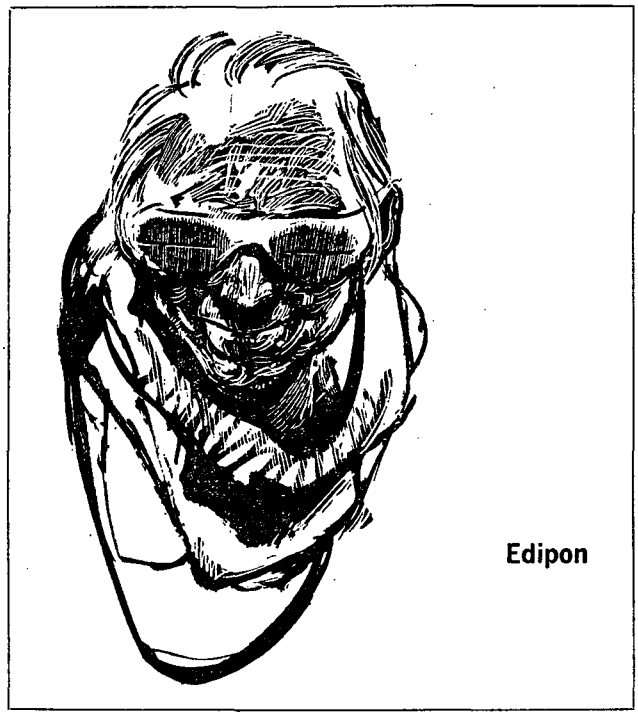

Edipon

prove the life of the slaves were being blocked completely by the slaves themselves. With a mumbled curse at the continued obduracy of the human race Jason sank the toe of his boot into the man.

"Find them there by big rock," was the immediate response.

There was a dark spot at the desert's edge in the indicated direction and when they approached Jason saw that it was an outcropping of rock that had been built up with a wall of bricks or boulders to a uniform height. A good number of men could be concealed behind that wall and he was not going to risk his precious slaves or even more precious skin anywhere near it. At his shout the line halted and settled to the sand while he stalked a few meters in front, settling his club in his hand and suspiciously examined the structure.

That there were unseen watchers was proven when a man appeared from around the corner and walked slowly towards Jason. He was dressed in loose-fitting robes and carried a basket on one arm, and when he had reached a point roughly halfway between Jason and the rock he had just quitted he halted and sat crosslegged in the sand, the basket at his side. Jason looked carefully in all directions and decided the position was safe enough. There were no places of concealment where armed men might have hidden and he had no fear of the single man. Club ready he walked out and stopped a full three paces from the other.

"Welcome, Ch'aka," the man said. "I was afraid we wouldn't be seeing you again after that little . . . difficulty we had."

He remained seated while he talked, stroking the few strands of his scraggly beard. His head was shaven smooth and as sunburned and leathery brown as the rest of his face, the most prominent feature of which was a magnificent prow of a nose that terminated in flaring nostrils and was used as sturdy support for a pair of handmade sunglasses. They appeared to be carved completely of bone and fit tightly to the face, their flat, solid fronts were cut with thin transverse slashes. This eye protection, the things could only have been for weak eyes, and the network of wrinkles indicated the man was quite old and would present no danger to Jason.

"I want something," Jason said, in straightforward, Ch'akaish manner.

"A new voice and a new Ch'aka—I bid you welcome. The old one was a dog and I hope he died in great pain when you killed him. Now sit friend Ch'aka and drink with me." He carefully opened the basket and removed a stone crock and two crockery mugs.

"Where you get poison drink?" Jason asked, remembering his local manners. This *d'zertano* was a smart one and had been able to tell instantly from Jason's voice that there had been a change in slaves. "And what your name?"

"Edipon," the ancient said as, uninsulted, he put the drinking apparatus back into the basket. "What is it that you want—within reason that is? We always need slaves and we are always willing to trade."

"I want slave you got. I trade you two for one."

The seated man smiled coldly from behind the shelter of his nose. "It is not necessary to talk as ungrammatically as the coastal barbarians, since I can tell by your accent that you are a man of education. What slave is it that you want?"

"The one that you just received from Fasimba. He belongs to me." Jason abandoned his linguistic ruse and put himself even more on guard, taking a quick look around at the empty sands. This dried up old bird was a lot brighter than he looked and he would have to stay on guard.

"Is that all you want?" Edipon asked.

"All I can think of at this moment. You produce this slave and perhaps we can talk more business."

"I have an even better idea than that."

Edipon's laugh had very dirty overtones and Jason sprang back when the oldster put two fingers into his mouth and whistled shrilly between them. There was the rustle of shifting sand and Jason wheeled to see men apparently climbing out of the empty desert, pushing back wooden covers over which the sand had been smoothed. There were six of them, with shields and clubs, and Jason cursed his stupidity at meeting Edipon on a spot of the other's choosing. He swung his club behind him but the oldster was already scampering for the safety of the rock. Jason howled in anger and ran at the nearest man who was still only halfway out of his hiding place. The man took Jason's blow on his upraised shield and was toppled back into the pit by the force of

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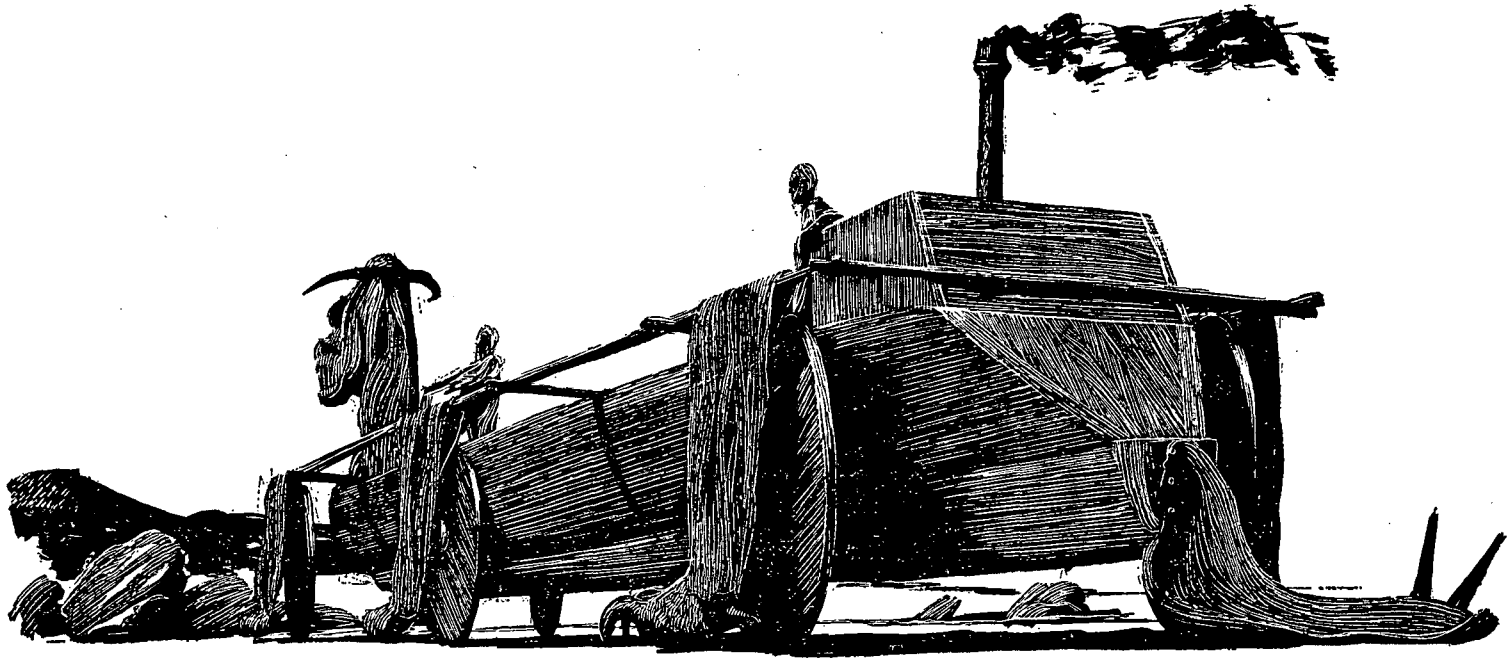
it. Jason ran on but another was ahead of him, swinging his own war club in readiness. There was no way around so Jason ran into him at full speed with all of his pendant teeth and horns gnashing and clattering. The man fell back under the attack and Jason split his shield with his club, and would have done further damage except that the other men arrived at that moment and he had to face them.

It was a brief and wicked battle, with Jason giving just a little more than he received. Two of the attackers were down and a third holding his cracked head when the weight of numbers carried Jason to the ground. He called to his slaves for aid, then cursed them when they only remained seated, while his arms were pinioned with rope and his weapons stripped from his body. One of the victors waved to the slaves who now stood and docilely marched into the desert. Jason was dragged, snarling with rage, in the same direction.

There was a wide opening in the desert-facing side of the wall and once through it Jason's anger instantly vanished. Here was one of the *caroj* that Ijale had told him about: there could be no doubt of it. He could now understand how, to her uneducated eye, there could exist an uncertainty as to whether the thing was an animal or not. The vehicle was a good ten meters long, shaped roughly like a boat, and bore on the front a large and obviously false animal head covered with fur and resplendent with rows of carved teeth and glistening crystal eyes. There were hide coverings and not-too realistic legs hanging about the thing, surely not enough camouflage to fool a sophisticated six-year old.

This sort of disguise might be good enough to take in the ignorant savages, but the same civilized child would recognize this as a vehicle as soon as he saw the six large wheels below. They were cut with deep treads and made from some resilient looking substance. No motive power was visible, but Jason almost hooted with joy at the prominent stink of burnt fuel. This crude looking contrivance had some artificial source of power, which might be the product of a local industrial revolution or have been purchased from off-world traders. Either possibility offered the chance of eventual escape from this nameless planet.

The slaves, some of them cringing with terror of the unknown, were kicked up the gangplank and into the *caro*. Four of the huskies who had subdued and bound Jason carried him up and dumped him onto the deck where he lay quietly and examined what could be seen of the desert-vehicle's mechanism. A post projected from the front of the deck and one of the men fitted what could only have been a tiller handle over the squared top of it. If this monolithic apparatus steered with the front pair of wheels it must be driven with the rear, so Jason flopped around on the deck until he could look towards the stern. A cabin, the width of the deck, was situated here, windowless and with a single inset door



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fitted with a grand selection of locks and bolts. Any doubt that this was the engine room was displaced by the black metal smokestack that rose up through the cabin roof.

"We are leaving," Edipon screeched and waved his thin arms in the air. "Bring in the entranceway. Narsisi stand forward to indicate the way to the *caro*. Now—all pray as I go into the shrine to induce the sacred powers to move us towards Putl'ko." He started towards the cabin, then stopped to point to one of the club bearers. "Erebo you lazy sod, did you remember to fill the watercup of the gods this time, because they grow thirsty?"

"I filled it, I filled it," Erebo muttered, chewing on a looted *kreno*.

Preparations made, Edipon went into the recessed doorway and pulled a concealing curtain over it. There was much clanking and rattling as the locks and bolts were opened and he let himself inside. Within a few minutes a black cloud of greasy smoke rolled out of the smokestack and was whipped away by the wind. Almost an hour passed before the sacred powers were ready to move, and they announced their willingness to proceed by screaming and blowing their white breath up in the air. Four of the slaves screamed counterpoint and fainted, while the rest looked as if they would be happier off dead. Jason had had some experience with primitive machines before so the safety valve on the boiler came as no great surprise. He was also prepared when the vehicle shuddered and began to move slowly out into the desert. From the amount of smoke and the quantity of steam escaping from under the stern he didn't think the engine was very efficient, but primitive as it was it moved the *caro* and its load of passengers across the sand at a creeping yet steady pace.

There were more screams from the slaves, and a few tried to leap over the side but were clubbed down. The robe-wrapped *d'zertanoj* were firmly working their way through the ranks of the captives, pouring ladlefuls of dark liquid down their throats. The first ones to receive it were already slumped unconscious or dead, though the chances were better that they were unconscious since there was no reason for their captors to kill them after going to such lengths to get them in the first place. Jason believed this, but the terrified slaves did not have the solace of his philosophy so struggled on, thinking that they were fighting for their lives. When Jason's turn came he did not submit meekly, in spite of his beliefs, and managed to bite some fingers and kick one man in the stomach before they sat on him, held his nose and poured a measure of the burning liquid down his throat. It hurt and he was dizzy, and he tried to will himself to throw up, but this was the last thing that he remembered.

To be concluded

IN TIMES TO COME

We haven't heard from Murray Leinster in some while—but he's with us in next month's lead story—"The Hate Disease."

The Med Service series which Leinster started here some few years back now—the previous yarns are out now in hard covers—picks up again with "The Hate Disease." As usual, epidemics of any kind involve a medical problem, and a psychological-sociological-political consequence that is, perhaps, more of a problem than the medical problem per se.

This time, the Med Service ran into a lulu! The "victims" of the disease had, as a primary symptom, a characteristic that made them loathed by the non-victims—and as a secondary symptom, a determination not *to be cured, and to see to it that non-victims caught the disease, too.*

And that, of course, made the planet Tallien Three one of the Wildest political-social-psychological medical messes in even the Med Service's wide-ranging experience!

The Editor.

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NEW APPLES IN THE GARDEN

Some problems are perfectly predictable–yet not in the sense that allows a preprogrammed machine to handle them—

BY KRIS NEVILLE

Illustrated by George Schelling

Eddie Hibbs reported for work and was almost immediately called out on an emergency. It was the third morning in succession for emergencies.

This time a section of distribution cable had blown in West Los Angeles. Blown cable was routine, but each instance merited the attention of an assistant underground supervisor.

Eddie climbed down the manhole with the foreman of the maintenance crew. There were deep pull marks on the lead sheath above where the cable had blown.

"Where'd they get it?" he asked.

"It came in from a job on the East Side."

"Sloppy work," Eddie said. "Water got in the splice?"

"These new guys . . ." the foreman said.

Eddie fingered the pull marks. "I think she's about shot anyway. How much is like this?"

"A couple of hundred feet."

"All this bad?"

"Yep."

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Eddie whistled. "About fifteen thousand dollars worth. Well. Cut her back to here and make splices. Stand over them while they do it."

"I'll need two men for a week."

"I'll try to find them for you. Send through the paper."

"I can probably find maybe another thousand miles or so that's about this bad."

"Don't bother," Eddie said.

That was Eddie's productive work during the morning. With traffic and two sections of street torn up by the water people, he did not get back to his office until just before lunch. He listened to the Stock Market reports while he drove.

He learned that spiraling costs had retarded the modernization program of General Electronics and much of their present equipment was obsolete in terms of current price factors. He was also told to anticipate that declining sales would lead to declining production, thereby perpetuating an unfortunate cycle. And finally he was warned that General Electronics was an example of the pitfalls involved in investing in the so-called High Growth stocks.

Eddie turned off the radio in the parking lot as the closing Dow-Jones' report was starting.

During lunch, he succeeded in reading two articles in a six-week-old issue of *Electrical World*, the only one of the dozen technical journals he found time for now.

At 12:35 word filtered into the department that one of the maintenance crew, Ramon Lopez, had been killed. A forty-foot ladder broke while atop it Lopez was hosing down a pothead, and he was driven backward into the concrete pavement by the high-pressure water.

Eddie tried to identify the man. The name was distantly familiar but there was no face to go with it. Finally the face came. He smoked two cigarettes in succession. He stubbed the last one out angrily.

"That was a tough one," his supervisor, Forester, said, sitting on the side of Eddie's desk. Normally exuberant, he was left melancholy and distracted by the accident. "You know the guy?"

"To speak to."

"Good man."

"After I thought about it a little bit," Eddie said, "I remembered he was transferring tomorrow. Something like this brings a man up short, doesn't it?"

"A hell of a shame. Just a hell of a shame."

They were silent for a minute.

"How was the market this morning?" Forester asked.

"Up again. I didn't catch the closing averages."

"I guess that makes a new high."

"Third straight day," Eddie said.

"Hell of a shame," Forester said.

"Yeah, Lopez was a nice guy."

"Well . . ." Forester's voice trailed off in embarrassment.

"Yeah, well . . ."

"I wanted to remind you about the budget meeting."

Eddie glanced at his watch. "Hour and a half?"

"Yeah. You know, I feel like . . . never mind. What about the burial transformers, you get on it yet?"

"The ones we're running in the water mains for cooling? They're out of warranty. None of the local shops can rewind them until the manufacturer sends out a field engineer to set them up for the encapsulation process."

"How long is that going to take?" Forester asked.

"They tell me several months. Still doesn't leave us with anything. The plant says they've fixed the trouble, but between them and the rewind shop, they can buck it back and forth forever."

"I guess we'll have to go back to the pad-mounted type."

"People with the Gold Medallion Homes aren't going to like the pads by their barbecues."

Forester uncoiled a leg. "Draw up a memorandum on it, will you, Eddie?" He stood up. "That thing sure got me today. There's just entirely too many of these accidents. A ladder breaking. I don't know."

Eddie tried to find something intelligent to say. Finally he said, "It was a rough one, all right."

After Forester left, Eddie picked up, listlessly from the top of the stack one of the preliminary reports submitted for his approval.

The report dealt with three thousand capacitors purchased last year from an Eastern firm, now bankrupt. The capacitors were beginning to leak. Eddie called the electrical laboratory to see what progress was being made on the problem.

The supervisor refreshed his memory from the records. He reported: "I don't have any adhesive man to work on it. Purchasing has half a dozen suppliers lined up—but none have any test data. I don't know when we'll get the time. We're on a priority program checking out these new, low-cost terminations."

"Can't we certify the adhesive to some AIEE spec or something?" Eddie asked.

"I don't know of any for sealing capacitors, Eddie. Not on the maintenance end, at least."

"Maybe Purchasing can get a guarantee from one of the suppliers?"

"For the hundred dollars of compound that's involved? What good would that do us?"

Eddie thanked him and hung up. He signed the preliminary report.

He turned to the next one.

At 2:30 Forester came by and the two of them made their way between the jig-saw projections of maple and mahogany to the Conference Room.

Fourteen men were involved in the conference, all from operating departments. They shuffled in over a five minute period, found seats, lit cigarettes, talked and joked with one another.

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When one of the assistants to the manager came in, they fell silent.

"Gentlemen," he said, "I think I'd better get right to the point today. The Construction Program in the Valley has now used up two bond issues. The voters aren't going to approve a third one."

He paused for effect then continued briskly:

"I see by the morning's *Times* that the mayor is appointing a watch-dog commission. I guess you all saw it, too. The Department of Water and Power of the City of Los Angeles is going to be badly—and I mean badly—in the red at the end of the fiscal year.

"We're in hot water.

"We do not seem to be getting through to the operating departments regarding the necessity for cost reduction. I have here last month's breakdown on the Bunker Hill substation 115 KV installation. Most of you have seen it already, I think. I had it sent around. Now—"

The analysis continued for some ten minutes to conclude with an explosion:

"We've got to impose a ten per cent across the board cut on operating expenses."

One of the listeners, more alert than the rest, asked, "That go for salaries?"

"For personnel making more than eight hundred dollars a month it does."

There was a moment of shocked silence.

"You can't make that stick," one of the supervisors said. "Half my best men will be out tomorrow looking for better offers—and finding them, too."

"I'm just passing on what I was told."

The men in the room shuffled and muttered under their breaths.

"O.K., that's the way they want it," one of the supervisors said.

"I've brought along the notices for the affected personnel. Please see they're distributed when you leave."

After the meeting, Forester walked with Eddie back to his desk.

"You be in tomorrow, Eddie?"

"I guess I will, Les. I really don't know, yet."

"I'd hate to lose you."

"It's going to make it pretty rough. A man's fixed expenses don't come down."

"I'll see what I can do for you, maybe upgrade the classification—"

"Thanks, Les."

Back at his desk, Eddie looked at his watch. Nearly time for the Safety Meeting. Lost-time injuries had been climbing for the last four months.

While waiting, he signed a sixty-three page preliminary report recommending a program for the orderly replacement of all transmission and distribution cable installed prior to 1946. It was estimated that the savings, in the long run, would total some quarter of a billion dollars. The initial expense, however, was astronomical.

After the Safety Meeting, Eddie prepared another memorandum indicating the acute need for a better training program and an increase in maintenance personnel. Shortage of qualified technicians was chronic.

At four twenty-five, the night supervisor phoned in to say he was having engine trouble with his new car and would be delayed until about six o'clock. Eddie agreed to wait for him.

Eddie dialed home to let his wife, Lois, know he would be late again. A modulated low-frequency note told him the home phone was out of order.

Ray Morely, one of the night-shift engineers, came in with coffee. "You still here, Eddie?"

"Yeah, until Wheeler makes it. His car's down."

"Market hit a new high."

"Yeah. I guess you heard about the meeting today?"

Ray sipped coffee. "Budget again? I missed the day crew. I got hung up in traffic and was a little late."

"A pay cut goes with it, this time."

"You're kidding?"

"Been by your desk yet?"

"No."

"I'm not kidding. Ten per cent for those making about eight hundred."

"Nobody's going to put up with that," Ray said. "We're in an engineering shortage. We've got ICBMs rusting in their silos all over the country because we can't afford the engineering maintenance—that's how bad it is. Everybody'll quit."

"I don't think they'll make it stick. Ramon Lopez, one of the truck crew, was killed today hosing down a high-voltage pothead."

"No kidding?"

Eddie told him about the accident.

"That was a rough one to lose, wasn't it?"

The phone rang.

Ray said, "I'll get it."

He listened for a minute and hung up. "There's an outage in the Silver Lake Area. The brakes on a bus failed and took out an overhead section."

Eddie sat back. "No sense in you going. With work traffic on the surface streets until the freeway gets fixed, they won't get the truck there until 6:30 or so."

"Right." Ray drank coffee reflectively. "You going looking?"

"I'm an old-timer. I got a lot of seniority. How about you?"

"I got bills. It's going to cost me near a hundred a month—that's a steep bite."

"I still think they'll back off."

"They'll have to," Ray said. "If not right now, when the pressure gets on. You ask me, we've got them by the short hair." He settled into the chair. "I see it as an organic phenomenon. When society gets as complex as ours, it has to grow more and more engineers. But there's a feedback circuit in effect. The more engineers we grow, the more complex society becomes. Each new

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one creates the need for two more. I get a sort of feeling of—I don't know—vitality, I guess, when I walk into, say, an automated factory. All that machinery and all that electronic gear is like a single cell in a living organism—an organism that's growing every day, multiplying like bacteria. And it's always sick, and we're the doctors. That's job security. We're riding the wave of the future. I don't think they'll make a salary cut stick."

"I hope you're right," Eddie said.

Eddie checked out at 7:15, when the night supervisor finally arrived. As he left the building, he noted that a burglar alarm down the street had gone off; probably because of a short circuit. The clanking set his nerves on edge. Apprehensively he felt a rising wind against his cheeks.

At home, he was greeted with a perfunctory kiss at the door.

"Honey," Lois told him, "you took the check book, and I didn't have any money."

"Something come up? I'm sorry."

"We're all out of milk. The milk man didn't come today. Their homogenizing machinery broke down. I phoned the dairy about nine; and then, of course, the phone has been on the blink since about eleven or a little before, so I couldn't ask you to bring some home."

"I kept trying to get you."

"I figured you had to work late again, when you weren't here at six, and I knew you'd be here when you got here."

Eddie sat down and she sat on the chair arm beside him. "How did it go today?"

He started to tell her about the wage cut and Ramon Lopez; but then he didn't want to talk about it. "So-so," he said. "There was an outage over in the Silver Lake Area just before I left."

"Fixed yet?"

"I doubt it," he said. "Probably a couple of more hours."

"Gee," she said, "when I think of all that meat in the deep freezer . . ."

"I wouldn't stock so much," he said. "I really wouldn't."

She twisted away from him. "Honey. I'm jittery. Something's . . . I don't know. In the air, I guess."

The wind rattled the windows.

While Lois was warming dinner, his son came in.

"Hi, Eddie."

"Hi, Larry."

"Eddie, when we gonna get the TV fixed?"

Eddie put down the newspaper. "We just don't have a hundred dollars or so right now." He searched for matches on the table by the chair. "Lois, oh, Lois, where're the matches?"

She came in. "They were all out Friday at the store, and I keep forgetting to lay in a supply. Use my lighter over there."

"About the TV—"

Lois was wiping her hands on the paper towel she had brought with her. "Replacement parts are hard to find for the older sets," she said. "Anyway. I read today Channel Three finally went off the air. That leaves only Two and Seven. And the programs aren't any good, now, are they? All those commercials and all?"

"They do use a lot of old stuff I've already seen," the son admitted, "but every once in a while there's something new."

"Let's talk about it some other time, Larry, O.K.?" Eddie said. "How's that? It's almost your bedtime. Studies done?"

"All but the Library report."

"Well, finish it, and —"

"I got to read the book down there. Two classes assigned it and they don't have the copies to let us check out. And I want to ask you about something, Eddie."

"Daddy's tired. His dinner's on. Come on, Eddie. I'll set it right now. And Larry, you've already eaten . . ."

After dinner, Eddie got back to the paper, the evening *Times*. It was down to eight pages, mostly advertising. There was a front-page editorial reluctantly announcing a price increase.

"They raise the price once more, and we'll just quit taking it," Lois said. "You read about the airplane crash in Florida? Wasn't that terrible? What do you think caused it?"

"Metal fatigue, probably," Eddie said. "It was a twenty-year-old jet."

"The company said it wasn't that at all."

"They always do," Eddie said.

"I don't guess the payroll check came today or you'd have mentioned it."

"Payroll's still all balled up. Somebody pressed a wrong button on the new machine and some fifty thousand uncoded cards got scattered all over the office."

"Oh, no! What do the poor people, who don't have bank accounts, do?"

"Just wait, like we wait."

"You had a bad day," Lois said. "I can tell."

"No . . ." Eddie said. "Not really, I guess."

"Still working on Saturday?"

"I guess so. Nothing was said. Maybe it'll get easier after the end of the month."

"You said it was all that new construction work in the Valley that's making you so shorthanded."

"That's part of it."

"They're not scheduled to finish until . . . when, sometime next year, isn't it?"

"The end of '81 right now."

"Eddie! Listen to me! I hardly ever see you any more. You're not going to have to put in all this overtime for the next two years!"

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"Of course not," Eddie said. "Maybe after this month, that's all, and the work load will level off."

Larry, dressed for bed, came in. "Eddie?"

"Your father's tired."

"I want to ask him something."

"What is it, Larry?" Eddie asked.

"Eddie, you know the little culture I was running for science class? Something's wrong. Will you look at it?"

"Daddy's . . ."

"I'll look at it, Lois." Eddie accompanied his son to his son's room.

"What do you think is wrong, Dad?"

"Well, let's see . . ."

"What is it?" Larry asked. "What made it stop growing?"

Eddie did not answer for a minute. Then: "You start with one or two . . . well, it's like this, Larry. I'm afraid it's dead. They grow exponentially. Figure out how much money you'd have at the end of a month if you started with just a penny and doubled your money every day. In just a little while, you'd have all the money in the world. Figure it out sometime. Things that grow exponentially, they just don't know when to quit. And your culture, here, it grew until the environment could no longer support it and all at once the food was eaten up and it died."

"I . . . see. . . . Something like that could just grow until it took over the whole world, couldn't it?"

Again Eddie was silent for a moment. Then he rumpled his son's hair. "That's science fiction, Larry."

Later, while they were listening to FM, there was a news break reporting a fire out of control in South Los Angeles.

"That's near Becky's, I'll bet," she said. "I better phone."

The phone was still out of order.

"I sure feel cut off without a phone."

After an interlude of music, Lois said, "Larry wants to be an engineer, now. I guess after what you said, maybe that's a pretty good thing."

Eddie looked up from his cigarette. "Why this all of a sudden?"

"One of his teachers told him what you said—there's a growing engineering shortage."

"I thought he wanted to be an astronaut."

"You know Larry. That was last week. His teacher said we're not going to start up the space program again. It's too expensive. We just don't have the technical manpower and materials to spare."

"We are in . . . But these kids, young kids they're turning out—they aren't getting the education today. And if anything, I sometimes think it almost makes our jobs even worse, correcting their mistakes. I sometimes wonder where it's all going to stop."

There was more news from the fire front.

Fire fighters were having a very difficult time. Two water mains had broken and the pressure was dropping. The fire was reported to have been caused by the explosion of a gas main. Rising winds did not promise to abate until dawn.

"I sure wish I could get through to Beck," Lois said. "Oh, I guess I told you, did I? Her sister has hypoglycemia, they found out. That's why she's been tired all the time."

"Never heard of it."

"Low blood sugar. It's caused by an overactive gland on the pancreas. And treatment is just the opposite of what you'd think, too. I'll bet you'd never guess. If you increase the amount of sugar in the diet, the gland becomes just that much more active to get rid of it and the hypoglycemia gets worse. It's what I'll bet you engineers call a feedback. Isn't that what you call it? Well . . . the way doctors treat it is to *reduce* the amount of sugar you eat. And after a little bit, the pancreas gets back its normal function, and the patient gets well. I told you you'd never guess!"

After a long time, Eddie said, very softly, "Oh."

Just after midnight, they went to bed.

"I've been . . ." Lois began and then stopped. "I don't know. Jumpy. The market was up again today. Another all-time high. Do you think there'll be another Crash? Like 'way back in 1929."

She could feel him lying tense beside her in the darkness. "No," he said slowly, "I don't think so. I don't think there'll be a Crash."

In spite of the warmth of the room, she could not suppress an involuntary shudder whose cause was nameless. Suddenly, she did not want to ask any more questions.

The wind was rattling the windows. ■

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A Knyght Ther Was

But the Knyght was a little less than Perfect, and his horse did not have a metabolism, and his "castle" was much more mobile–timewise!–than it had any business being!

by Robert F. Young

Illustrated by Leo Summers

A Knyght ther was, and that a worthy man,
That fro the tyme that he first bigan
To ryden out, he loved chivalrye,
Trouthe and honour, fredom and curteisye
—THE CANTERBURY TALES

I

Mallory, who among other things was a time-thief, rematerialized the time-space boat *Yore* in the eastern section of a secluded valley in ancient Britain and typed CASTLE, EARLY SIXTH-CENTURY on the lumillusion panel. Then he stepped over to the control-room telewindow and studied the three-dimensional screen. The hours was 8:00 p.m.; the season, summer; the Year 542 A.D.

Darkness was on hand, but there was a full moon rising and he could see trees not far away—oaks and beeches, mostly. Roving the eye of the camera, he saw more trees of the same species. The "castle of Yore" was safetly ensconced in a forest. Satisfied, he turned away.

If his calculations were correct, the castle of Carbonek stood in the next valley to the south, and on a silver table in a chamber of the castle stood the object of his quest.

If his calculations were correct.

Mallory was not one to keep himself in suspense. Stepping into the supply room, he stripped down to his undergarments and proceeded to get into the custom-built suit of armor which he had purchased expressly for the operation. Fortunately, while duplication of early sixth-century design had been mandatory, there had been no need to duplicate early sixth-century materials, and sollerets, spurs, greaves, cuisses, breastplate, pauldrons, gorget, arm-coverings, gauntlets, helmet, and chain-mail vest had all been fashioned of light-weight alloys that lent ten times as much protection at ten times less poundage. The helmet was his particular pride and joy: in keeping with the period-piece after which it had been patterned, it looked like an upside-down metal wastepaper basket, but the one-way transparency of the special alloy that had gone into its construction gave him unrestricted vision, while two inbuilt audio-amplifiers performed a corresponding service for his hearing.

The outer surface of each piece had been burnished to a high degree, and he found himself a dazzling sight

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indeed when he looked into the supply-room mirror. This effect was enhanced no end when he buckled on his chrome-plated scabbard and red-hilted sword and hung his snow-white shield around his neck. His polished spear, when he stood it beside him, was almost anticlimactic. It shouldn't have been. It was a good three and one-half inches in diameter at the base, and it was as tall as a young flagpole.

As he stood there looking at his reflection, the red cross in the center of the shield took on the hue of freshly-shed blood. The period-piece expert who had designed the shield had insisted on the illusion, saying that it made for greater authenticity, and Mallory hadn't argued with him. He was glad now that he hadn't. Raising the visor of his helmet, he winked at himself and said, "I hereby christen ye 'Sir Galahad'."

Next, he bethought himself of his steed. Armor clanking, he left the supply room and walked down the short passage to the rec-hall. The rec-hall occupied the entire forward section of the TSB and had been designed solely for the benefit of the time-tourists whom Mallory regularly conducted on past-tours as a cover-up for the illegal activities which he pursued in between trips. In the present instance, however, the hall went quite well with the *Yore's* lumillusioned exterior, possessing, with its gallery-like mezzanine, its long snack table, and its imitation flagstone flooring, an early sixth-century aspect of its own—an aspect marred only slightly by the "anachronistic" telewindows inset at regular intervals along the walls.

Mallory's steed stood in a stall-like enclosure that was formed by the tourist-bar and one of the walls, and it was a splendid "beast" indeed—as splendid a one as the twenty-second century robotics industry was capable of creating. Orginally, Mallory had planned on bringing a real horse with him, but as this would have necessitated his having to learn how to ride, he had decided against it. The decision had been a wise one: "Easy Money" looked more like a horse than most real horses did, could travel twice as fast, and was as easy to ride and to maneuver as a golp jetney. It was light-brown in color with a white diamond on its forehead, it was equipped with a secret croup-compartment and an inbuilt saddle, and its fetlock-length trappings were made of genuine synthisilk threaded with gold. It wore no armor—it did not need to: weapons manufactured during the Age of Chivalry could no more penetrate its "hide" than a tooth pick could.

Come on, Easy Money, Mallory encephalopathed. *You and I have a little job to do.*

The rohorse emitted several realistic whinnies, backed out of its "stall", trotted smartly over to his side, and nuzzled his right pauldron. Mallory mounted—not gracefully, it is true, but at least without the aid of the winch he would have needed if his armor had been manufactured in the sixth century—and inserted the red pommel of his spear in the stirrup socket. Then, activating the *Yore's* lock, he rode across the imaginary drawbridge that spanned the mirage-moat, and set forth into the forest. As the "portcullis" closed behind him, symbolically bringing phase one of Operation Sangraal to a close, he thought of Jason Perfidion.

Standing in front of the floor-to-ceiling, wall-to-wall fireplace in the big balconied room, Perfidion said, "Mallory, you're wasting your time. Worse, you're wasting mine."

The room climaxed a vertical series of slightly less sumptuous chambers known collectively as the Perfidion Tower, and the Perfidion Tower stood with a score of balconied brothers on a blacktop island in the exact center of Kansas' largest golp course. A short distance from the fraternal gathering stood yet another tower—the false tower into which Mallory had lumillusioned his TSB upon his arrival. On the Golp Terrace, as the blacktop island was called, everyone and everything conformed—or else.

The room itself was known to time-thieves as "Perfidion's Lair". And yet there was nothing about Jason Perfidion—nothing physical, that is—that suggested the predator. He was Mallory's age—thirty-three—tall, dark of hair, and strikingly handsome. He looked like—and was—a highly successful businessman with a triplex on Get-Rich-Quick Street, and he gave the impression that he was as honest as the day was long. Just the same, the predator was there, and if you were alert enough you could sometimes glimpse it peering out through the smoky windowpanes of his eyes.

It wasn't peering out now, though. It was sleeping. However, it was due to wake up any second. "Then you're not interested in fencing the Holy Grail?" Mallory asked.

Annoyance intensified the slight swarthiness of Perfidion's cheeks. "Mallory, you know as well as I do that the Grail never really existed, that it was nothing more than the mead-inspired daydream of a bunch of quixotic knights. So go and get your hair cut and forget about it."

"But suppose it *did* exist," Mallory insisted. "Suppose, tomorrow afternoon at this time, I were to come in here and set it down on this desk here? How much could you get for it?"

Perfidion laughed. "How much *couldn't* I get for it! Why, without even stopping to think I can name you a dozen collectors who'd give their right arm for it."

"I'm not interested in right arms," Mallory said. "I'm interested in dollars. How many Kennedees could you get for it?"

"A megamillion—maybe more. More than enough, certainly, to permit you to retire from time-lifting and to take up residence on Get-Rich-Quick Street. But it doesn't exist, and it never did, so get out of here, Mallory, and stop squandering my valuable time."

Mallory withdrew a small stereophoto from his breast

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pocket and tossed it on the desk. "Have a look at that first—then I'll go," he said.

Perfidion picked up the photo. "An ordinary enough yellow bowl," he began, and stopped. Suddenly he gasped, and jabbed one of the many buttons that patterned his desktop. Seconds later, a svelte blonde whom Mallory had never seen before stepped out of the lift tube. Like most general-purpose secretaries, she wore a maximum of makeup and a minimum of clothing, and moved in an aura of efficiency and sex. "Get me my photo-projector, Miss Tyler," Perfidion said.

When she returned with it, he set it on his desk and inserted the stereophoto. Instantly, a huge cube materialized in the center of the room. Inside the cube there was a realistic image of a resplendent silver table, and upon the image of the table stood an equally realistic image of a resplendent golden bowl. Perfidion gasped again.

"Unusual workmanship, wouldn't you say?" Mallory said.

Perfidion turned toward the blonde. "You may go, Miss Tyler."

She was staring at the contents of the cube and apparently did not hear him. "I said," he repeated, "that you may go, Miss Tyler."

"Oh. Yes . . . yes sir."

When the lift-tube door closed behind her, Perfidion turned to Mallory. For a fraction of a second the predator was visible behind the smoky windowpanes of his eyes; then, quickly, it ducked out of sight. "Where was this taken, Tom?"

"It's a distance-shot," Mallory said. "I took it through one of the windows of the church Joseph of Arimathea build in Glastonbury."

"But how did you know—"

"That it was there? Because it *had* to be there. Sometime ago, while escorting a group of tourists around ancient Britain, I happened to witness Joseph of Arimathea's landing—and happened to catch a glimpse of what he brought with him. I used to think that the Grail was a pipe dream, too, but when I saw it with my own eyes, I knew that it couldn't have been. However, I knew I'd need evidence to convince you, so I jumped back to a later place-time and got a shot of it."

"But why a shot, Tom? Why didn't you lift it then and there?"

"You concede that it is the Grail then?"

"Of course it's the Grail—there's not the slightest question about it. Why didn't you lift it?"

"Well, for one thing, I wanted to make sure that lifting it would be worth my while, and for another, Gastonbury wasn't the logical place-time from which to lift it, because, assuming that the rest of the legend is also true, it was seen after that place-time. No time-thief ever bucked destiny yet and came out the winner, Jason; I play my percentages."

"I know you do, Tom. You're one of the best time-lift men in the business, and the Past Police would be the first to admit it . . . I daresay you've already pinpointed the key place-time?"

Mallory grinned, showing his white teeth. "I certainly have, but if you think I'm going to divulge it, you're sadly mistaken, Jason. And stop looking at my hair—it won't tell you anything beyond the fact that I've been using Hair-haste. Shoulder-length hair was the rage in more eras than one."

Perfidion smiled warmly, and clapped Mallory on the back. "I'm not trying to ferret out your secret, Tom. I know better than that. Lifting is your line, fencing mine. You bring me the Grail, I'll sell it, take my cut, and everything will be fine. You know me, Tom."

"I sure do," Mallory said, taking the stereophoto out of the projector and returning it to his breast pocket.

Perfidion snapped his fingers. "A happy thought just occurred to me! I've got a golp date with Rowley of Puriproducts, so why don't you join us, Tom? You play a pretty good game, as I recall."

Mollified, Mallory said, "I'll have to borrow a set of your jetsticks."

"I'll get them for you on the way down. Come on, Tom."

Mallory accompanied him across the room. "Keep mum about this to Rowley now," Perfidion said confidentially. "He's a potential customer, but we don't want to let the cat out of the bag yet, do we? Or should I say 'the Grail'."He took time out to grin at his little joke, then, "By the way, Tom, I take it you're all set as regards costume, equipment and the like."

"I've got the sweetest little suit of armor you ever laid eyes on," Mallory said.

"Fine—no need for me to offer any advice in that respect then." Perfidion opened the lift door. "After you, Tom."

They plummeted down the tube together.

It had been a good game of golp—from Mallory's standpoint, anyway. He had trounced Rowley roundly, and he would have inflicted a similar ignominy upon Perfidion had not the latter been called away in the middle of the game and been unable to return till it was nearly over. Oh well, Mallory thought, encephalo-guiding his rohorse through the ancient forest, there'll be other chances. Aloud, he said, "Step lively now, Easy Money, and let's get this caper over with so we can return to civilization and start feeling what it's like to be rich."

In response to the encephalo-waves that had accompanied his words, Easy Money increased its pace, the infra-red rays of its eye units illumining its way. In places, light from the rising moon seeped through the foliage, but otherwise darkness was the rule. The air was cool and damp—the sea was not far distant—and the sound of frogs and insects was omnipresent and now

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and then there was the rustling sound of some small and fleeing forest creature.

Presently the ground began to rise, and not long afterward the trees thinned out temporarily and rohorse and rider emerged on the moonlit crest of the ridge that separated the two valleys. In the distance Mallory made out the moon-gilt towers and turrets of a large castle, and knew it to be Carbonek beyond a doubt. He sighed with relief. He was all set now—provided his masquerade went over. Conversely, if it didn't go over he was finished: his sword and his spear were his only weapons, and his shield and his armor, his only protection. True, each article was superior in quality and durablity to its corresponding article in the Age of Chivalry, but otherwise none of them was anything more than what it seemed. Mallory might be a time-thief; but within the framework of his profession he believed in playing fair.

In response to his encephalopathed directions, Easy Money picked its way down the slope of the ridge and re-entered the forest. Not long afterward it stepped onto what was euphemistically referred to in that day and age as a "highway" but which in reality was little more than a wide, hoof-trampled lane. As Mallory's entire plan of action was based on boldness, he spurned the shadows of the bordering oaks and beeches and encephalpathed the rohorse to keep to the center of the lane. He met no one, however, despite the earliness of the hour, nor had he really expected to. It was highly improbable that any freemen would be abroad after dark, and as for the knight-errants who happened to be in the neighborhood, it was highly improbable that any of them would be abroad after dark either.

He grinned. To read *Le Morte d'Arthur*, you'd think that the chivalry boys had been in business twenty-four hours a day, slaying ogres, rescuing fair damosels, and searching for the Sangraal; but not if you read between the lines. Mallory had read "Arthur" only cursorily, but he had had a hunch all along that in the majority of cases the quest for the Sangraal had served as an out, and that the knights of the Table Round had spent more time wenching and wassailing than they had conducting their so-called dedicated search, and the hunch had played an important role in the shaping of his strategy.

The highway turned this way and that, never pursuing a straight course unless such a logical procedure was unavoidable. Once, he thought he heard hoofbeats up ahead, but he met no one, and not long afterward he saw the pale pile of Carbonek looming above the trees to his left, and encephalo-guided Easy Money into the lane that led to the entrance. There was no moat, but the portcullis was an imposing one. Flanking it on either side was a huge stone lion, and framing it were flaming torches in regularly-spaced niches. Warders in hauberk and helmet looked down from the lofty wall, their halberds gleaming in the dancing torchlight. Mallory swallowed: the moment of truth had arrived.

He halted Easy Money and canted his white shield so that the red cross in its center would be visible from above. Then he marshalled his smattering of Old English. "I hight Sir Galahad of the Table Round," he called out in as bold a voice as he could muster. "I would rest my eyes upon the Sangraal.

Instantly, confusion reigned upon the wall as the warders vied with one another for the privilege of operating the cumbersome windlass that raised and lowered the portcullis, and presently, to the accompaniment of a chorus of creaks and groans and scrapings, the ponderous iron grating began to rise. Mallory forced himself to wait until it had risen to a height befitting a knight of Sir Galahad's caliber, then he rode through the gateway and into the courtyard, congratulating himself on the effectiveness of his impersonation.

"Ye will come unto the chamber of the Sangraal sixty paces down the corrridor to thy left eftsoon ye enter the chief fortress, sir knight," one of the warders called down. "An ye had arrived a little while afore, ye had encountered Sir Launcelot du Lake, the which did come unto the fortress and enter in, wherefrom he came out anon and departed."

Mallory would have wiped his forehead if his forehead had been accessible and if his hands had not been encased in metal gloves. Fooling the warders was one thing, but passing himself off as Sir Galahad to the man who was Sir Galahad's father would have been quite another. He had learned from the pages of his near-namesake's "Arthur" that Sir Launcelot had visited Carbonek before Sir Galahad had, but the pages had not revealed whether the time-lapse had involved minutes, hours, or years, and for that matter, Mallory wasn't altogether certain whether the second visit they described had been the real Sir Galahad's, which meant failure, or a romanticized version of his own, which meant success. His near-namesake was murky at best, and reading him you were never sure where anybody was, or when any given event was taking place.

The courtyard was empty, and after crossing it, Mallory dismounted, encephalopathed Easy Money to stay put, and climbed the series of stone steps that led to the castle proper. Entering the building unchallenged, he found himself at the junction of three corridors. The main one stretched straight ahead and debouched into a large hall. The other two led off at right angles, one to the left and one to the right. Boisterous laughter emanated from the hall, and he could see knights and other nobles sitting at a long banquet table. Scattered among them were gentlewomen in rich silks, and hovering behind them were servants bearing large demijohns. He grinned. Just as he had figured—King Pelles was throwing a whingding.

Quickly, Mallory turned down the left-hand corridor and started along it, counting his footsteps. Rushes rustled beneath his feet, and the flickering light of wall-torches gave him a series of grotesque shadows. He saw

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no one: all of the servants were in the banquet hall, pouring wine and mead. He laughed aloud.

Forty-eight paces sufficed to see him to the chamber door. It was a perfectly ordinary door. Opening it, he thought at first that the room beyond was ordinary, too. Then he saw the burning candles arranged along the walls, and beneath them, standing in the center of the floor, the table of silver. The table of the Sangraal . . .

There was no Sangraal on the table, however. There was no Sangraal in the room, for that matter. There was a girl, though. She was huddled forlornly in a corner, and she was crying.

II

Mallory laid his spear aside, strode across the room, and raised the girl to her feet. "The Sangraal," he said, forgetting in his agitation the few odds and ends of Old English he had memorized. "Where is it!"

She raised startled eyes that were as round, and almost as large, as plums. Her face was round, too, and faintly childlike. Her hair was dark-brown, and done up in a strange and indeterminate coiffeur that was as charming as it was disconcerting. Her ankle-length dress was white, and there was a bow on the bodice that matched the plum-blueness of her eyes. A few cosmetics, properly applied, would have turned her into an attractive woman, and even without them, she rated a second look.

She stared at him for some time, then, "Surely ye be an advision, sir," she said. "I . . . I know ye not."

Mallory swung his shield around so that she could see the red cross. "Now do you know me?"

She gasped, and her eyes grew even rounder. "Sir . . . Sir Galahad! Oh, fair knight, wherefore did ye not say?"

Mallory ignored the question. "The Sangraal," he repeated. "Where is it?"

Her tears had ceased temporarily; now they began again. "Oh, fair sir!" she cried, "ye see tofore you a damosel at mischief, the which was given guardianship of the Holy Vessel at her own request, and bewrayed her trust, a damosel—"

"Never mind all that," Mallory said. "Where's the Sangraal?"

"I wot not, fair sir."

"But you must know if you were guarding it!"

"I wot not whither it was taken."

"But you must wot who took it."

"Wot I well, fair knight. Sir Launcelot, the which is thy father, bare it from the chamber."

Mallory was stunned. "But that's impossible! My fa—Sir Launcelot wouldn't steal the Sangraal!"

"Well I wot, fair sir; yet steal it he did. Came he unto the chamber and saith, I hight Sir Launcelot du Lake of the Table Round, whereat I did see his armor to be none other; so then took he the Vessel covered with the red samite and bare it with him from the chamber, whereat I—"

"How long ago?"

"But a little while afore eight of the clock. Sithen I have wept. I know now no good knight, nor no good man. And I know from thy holy shield and from they good name that thou art a good knight, and I beseech ye therefore to help me, for ye be a shing knight indeed, wherefore ye ought not to fail no damosel which is in distress, and she besought you of help."

Mallory only half heard her. Sir Launcelot was too much with him. It was inconceivable that a knight of such noble principles would even consider touching the Sangraal, to say nothing of making off with it. Maybe, though, his principles hadn't been quite as noble as they had been made out to be. He had been Queen Guinevere's paramour, hadn't he? He had lain with the fair Elaine, hadn't he? When you came right down to it, he could very well have been a scoundrel at heart all along—a scoundrel whose true nature had been toned down by writers like Malory and poets like Tennyson. All of which, while it strongly suggested that he was capable of stealing the Sangraal, threw not the slightest light on his reason for having done so. Mallory was right back where he had started from.

He turned to the girl. "You said something about needing my help. What do you want me to do?"

Instantly, her tears stopped and she clasped her hands together and looked at him with worshipful eyes. "Oh, fair sir, ye be most kind indeed! Well I wot from thy shining armor that ye—"

"Knock it off," Mallory said.

"Knock it off? I wot not what—"

"Never mind. Just tell me what you want me to do."

"Ye must bear me from the castle, fair sir, or the king learns I have bewrayed my trust and wreaks his wrath upon me. And then ye must help me regain the Holy Cup and return it to this chamber."

"We'll worry about getting the Cup back after we're beyond the walls," Mallory said, starting for the door. "Come on—they're all in the banquet hall and as drunk as lords—they won't even see us go by."

She hung back. "But the warders, fair sir—they be not enchafed. And King Pelles, by my own wish, did forbid them to pass me."

Mallory stared at her. "By your own wish! Well of all the crazy—" Abruptly he dropped the subject. "All right then—how *do* we get out of here?"

"There lieth beneath the fortress and the forest a parlous passage wherein dwells the fiend, the which I have much discomfit of. But with ye aside me, fair knight, there is naught to fear."

Mallory had read enough Malory to be able to take sixth-century fiends in his stride. "I'll have to take my horse along," he said. "Is there room for it to pass?"

"Yea, fair sir. The tale saith that aforetime many knights did ride out beneath the fortress and the forest

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and did smite the Saxons, Saracens, and Pagans, the which did compass the castle about, from behind, whereupon the battle was won."

Mallory stepped outside the chamber, the girl just behind him, and encephalopathed the necessary directions. After a moment, Easy Money came trotting down the corridor to his side. The girl gasped, and, to his astonishment, threw her arms around the rohorse's neck. "He is a noble steed indeed. fair sir," she said, "and worthy of a knight fitting to sit in the Siege Perilous." Presently she stepped back, frowning. "He . . . he is most cold, fair sir."

"All horses of that breed are," Mallory explained. "Incidentally, his name is 'Easy Money'."

"La! such a strange name."

"Not so strange." Mallory raised his visor, making a mental note to see to it that any and all suits of armor he might buy in the future were air-conditioned. He got his spear. "Let's be on our way, shall we?"

"Ye . . . ye have blue eyes, fair sir."

"Never mind the color of my eyes—let's get out of here."

She seemed to make up her mind about something. "An ye will follow me, sir knight," she said, and started down the corridor.

A ramp, the entrance of which was camouflaged by a rotating section of the inner castle wall, gave access to the subterranean passage. The passage itself, in the flickering light of the torch that the girl had brought along, appeared at first to be nothing more than a natural cave enlarged through the centuries by the steam that still flowed down its center. Presently, however, Mallory saw that in certain places the stone walls had been cut back in such a way that the space on either side of the steam never narrowed to a width of less than four feet. He saw other evidence of human handiwork too—dungeons. They were little more than shallow caves now, though, their iron gratings having rusted and fallen away.

After proceeding half a hundred yards, he paused. "I don't know what we're walking for when we've got a perfectly good horse at our disposal," he told the girl. "Come on, I'll help you into the saddle and I'll jump on behind."

She shook her head. "No, fair knight, it is not fitting for a gentlewoman to ride tofore her champion. Ye will mount, and I will ride behind."

"Suit yourself," Mallory said. He climbed into the saddle with a clank and a clatter, and helped her up on Easy Money's croup. "By the way, you never did tell me your name."

"I hight the damosel Rowena."

"Pleased to meet you," Mallory said. *Giddy-ap. Easy Money,* he encephalopathed.

They rode in silence for a little while, the light from Rowena's torch dancing acappella rigadoons on bare walls and dripping ceilings, Easy Money's hoofbeats hardly audible above the purling of the stream. Presently Rowena said, "It were best that ye drew out thy sword, fair sir, for anon the fiend will beset us."

"He hasn't beset us yet," Mallory pointed out.

"La! fair sir, he will."

He saw no harm in humoring her, and did as she had suggested. "You mentioned something a while back about having been given guardianship of the Sangraal at your own request," he said. "How did that come about?"

"List, fair sir, and I will tell ye. But first I must tell ye of Sir Bors de Ganis, of which Sir Lionel is brother. It happed one day that Sir Bors did ride into a forest in the Kingdom of Mennes unto the hour of midday, and there befel him a marvelous adventure. So he met at the departing of the two ways two knights that led Lionel, his brother, all naked, bounden upon a strong hackney, and his hands bounden tofore his breast. And every each of them held in his hands thorns wherewith they went beating him so sore that the blood trailed down more than in an hundred places of his body, so that he was all blood tofore and behind, but he said never a word; as he which was great of heart he suffered all that ever they did to him as though he had felt none anguish.

"Anon Sir Bors dressed him to rescue him that was his brother; and so he looked upon the other side of him, and saw a knight which brought a fair gentlewoman, and would have set her in the thickest place of the forest for to have been the more surer out of the way from them that sought him. And she which was nothing assured cried with a high voice: 'Saint Mary succor your maid.' And anon she espied where Sir Bora came riding. And when she came nigh him she deemed him a knight of the Round Table, whereof she hoped to have some comfort; and then she conjured him: By the faith that he ought unto him in whose service thou art entered in, and for the faith ye owe unto the high order of knighthood, and for the noble King Arthur's sake, that I suppose that made thee knight, that thou help me, and suffer me not to be shamed of this knight. When—"

"Just a minute," Mallory interrupted, thoroughly bewildered and simultaneously afflicted with an irrational sense of *deja vu.* "This gentlewoman you speak of—would she by any chance be you?"

"Wit ye well, fair sir. When—"

"But if she's you, why don't you use the first person singular instead of the third?"

"I wot not what—"

"Why don't you use 'I' instead of 'she' when you refer to yourself directly?"

"It would not be fitting, fair knight. When Bors heard her say thus he had so much sorrow there he nyst not what to do. For if I let my brother be in adventure he must be slain, and that would I not for all the earth. And if I help not the maid she is shamed for ever, and

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also she shall lose her virginity the which she shall never get again. Then lift he up his eyes and said weeping: Fair sweet Lord, whose liege man I am, keep Lionel, my brother, that these knights slay him not, and for pity of you, and for Mary's sake, I shall succor this maid. Then dressed he him unto the knight the which had the gentlewoman, and then—"

"Hist!" Mallory whispered. "I heard something."

For a moment the light flared wildly as though she had nearly dropped the torch. "Wh . . . whence came the sound, fair knight?"

"From the other side of the stream." He peered into the vacillating shadows, but saw nothing but the darker shadows of one of the innumerable man-made caves. The sound he had heard had brought to mind the dull clang that metal makes when it collides with stone, and it had been so faint as to have been barely audible above the purling of the stream. Thinking back, he was not altogether certain that he had heard it at all. "My imagination's getting the best of me, I guess," he said presently. "There's no one there."

Her warm breath penetrated the crevices of his gorget and fanned the back of his neck. "Ye . . . ye ween not that it could have been the fiend prowling?"

"Of course I ween not! Relax, and finish your story. But get to the point, will you?"

"An . . . an it so please. . . . And then Sir Bors cried: Sir knight, let your hand off that maiden, or ye be but dead. And then he set down the maiden, and was armed at all pieces save he lacked his spear. Then he dressed his shield, and drew out his sword, and Bors smote him so hard that it went through his shield and habergeon on the left shoulder. And through great strength he beat him down to the earth, and at the pulling out of Bors' spear there he swooned. Then came Bors to the maid and said: How seemeth it to you of this knight ye be delivered at this time? Now sir, said she, I pray you lead me there as this knight had me. So shall I do gladly: and took the horse of the wounded knight, and set the gentlewoman upon him, and so brought her as she desired. Sir knight, said she, ye have better sped than ye weened, for an I had lost my maidenhead, five hundred men should have died for it. What knight was he that had you in the forest? By my faith, said she, he is my cousin. So wot I never with what engyn the fiend enchafed him, for yesterday he took me from my father privily; for I nor none of my father's men mistrusted him not, and if he had had my maidenhead he should have died for the sin, and his body shamed and dishonored for ever. Thus as—"

"*Shhh!*"

This time, Mallory was certain that he had heard something. The sound had had much in common with the previous sound, except that it had suggested metal scraping against, rather than colliding with, stone. Directly across the stream was another cave, this one shallow enough to permit the torchlight to penetrate its deeper shadows, and looking into those shadows, he caught a faint gleam of reflected light.

Rowena must have caught it, too, for he heard her gasp behind him. "It were best that I thanked ye now for thy great kindness, fair knight," she said, "for anon we be no longer on live."

"Nonsense!" Mallory said. "If this fiend of yours is anywhere in the vicinity, he's probably more afraid of us than we are of him."

The cave was behind them now. "Per . . . peradventure he hath already had meat," Rowena said hopefully. "The tale saith that and the fiend be filled, he becomes aweary and besets not them the which do pass him by in peace."

"I'll keep my sword handy just in case he changes his mind," Mallory said. "Meanwhile, get on with your autobiography—only for Pete's sake, cut it short, will you?"

"An it please, fair sir. Thus as the fair gentlewoman stood talking with Sir Bors there came twelve knights seeking after her, and anon she told them all how Bors had delivered her; then they made great joy, and besought him to come to her father, a great lord, and he should be right welcome. Truly, said Bors, that may not be at this time, for I have a great adventure to do in this country. So he commended them unto God and departed. The fair gentlewoman did grieve mickle to see him leave, and she saith, sir knights, noble was the service that brave knight did render unto thy liege's daughter in the saving of her maidenhead the which she could never get again, for that be none other than his own brother the which he fauted. Therefore, noble must be both his king and his cause, wherefore it be befitting that a gentlewoman of thy liege's daughter's nature leave the castle of her father betimes that she may render fitting service to her succor's cause and be worthy of his deed. Thus spake this fair gentlewoman, whereat she did mount upon her palfrey and so departed her from thence and did ride as fast as her palfrey might bear her, whereupon after many days she came to the castle of Carbonek and did seek out King Pelles and did beseech him that she might be made guardian of the Sangraal, whereat he did graciously consent to her request and did consent also that she be made prisoner in the fortress by her own wish. And now she was bewrayed her trust, fair sir, and the table of silver whereon the Sangraal stood stands empty.

For some time after she finished talking, Mallory was silent. Was she trying to pull his leg? he wondered. Or were the gentlewomen of her day and age really as high-minded and as feathered-brained as she would have him believe? He decided not to go into the matter for the moment. "Tell me, Rowena," he said, "if the Sangraal is visible only to those who are worthy of it, as I have been led to believe, how are any of those wassail-

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ers whooping it up back there in that banquet hall going to know whether it's gone or not?"

"It be ofttimes averred that all cannot see the Holy Cup, as ye say, fair knight. Natheless, all that have come unto the chamber sithen my trust began, they did see it, and Sir Launcelot, the which is much with sin, he did see it—and did take it."

"He's not going to get very far with it, though," Mallory said. And then, "How long is the tunnel anyway?"

"Anon we shall see the stars, fair sir."

She was right, and a few minutes later, after rounding a turn in the passage, they emerged upon the bank of a small river. The subterranean stream that had kept them company emerged, too, and joined its larger sister on the way to the sea. On either hand, cliffs rose up, and the susurrus of waves breaking on sand could be heard in the distance.

Mallory guided Easy Money upstream to where the cliffs dwindled down to thickly forested slopes. It took him but a moment to orientate himself, and presently rohorse and riders were headed in the direction of the highway. "Now," said he, "if you'll tell me where you want to be dropped off, I'll see what I can do about getting the Grail back."

There was a brief silence. Then, "An . . . an ye wish, ye may leave me here."

He halted Easy Money, dismounted, and lifted her down to the ground. He looked around, expecting to see a habitation of some sort. He saw nothing but trees. He faced the girl again. "Don't you have any friends or relatives you can stay with?"

An argent shaft of moonlight slanting down through the foliage illumined her face. "There be none nigh, fair sir, nor none nearer than an hundred miles. I shall abide your again-coming here in the forest."

Mallory stared at her. She didn't look—or act either, for that matter—as though she knew enough to get in out of the rain. "Abide here in the forest! Why, you wouldn't last a week!"

"But ye will return hither with the Sangraal long afore that, whereupon we two together shall return the Holy Vessel to the chamber and I shall not be made to suffer the severing of my two hands."

He was aghast. "They wouldn't dare cut off your hands!"

"They dare much, fair knight. Know ye naught of the customs of the land?"

He was silent. What in the world was he going to do about her? She would probably wait here for him until she starved to death or, equally as distressing, until she was apprehended. Abruptly he shrugged his shoulders —to the extent that his pauldrons permitted—and remounted the rohorse. Why should it matter to him what became of her? He'd returned to the Age of Chivalry to steal the Sangraal, not to play nursemaid to damosels in distress. "Don't take any wooden nickels now," he said.

Two tiny stars appeared in the pale regions of her eyes and twinkled down her cheeks. "May the good Lord speed ye upon thy quest, fair knight, and may He guard ye well."

"Oh, for Pete's sake!" Mallory said, and reaching down, pulled her up onto Easy Money's croup. "I have a castle not far from here. I'll drop you off, then I'll go after the Sangraal."

Her breath was a warm little wind seeping through the crevices of his gorget. "Oh, fair sir, ye be the noblest of all the knights in all the land, and I shall serve thee faithfully for the rest of my days!"

The rohorse whinnied. *Giddy-ap, Easy Money,* Mallory encephalopathed, and they started out.

III

Rowena fell for the *Yore* hook, line, and sinker. Not even the modern interior gave her pause. Those objects which happened to be beyond her ken—and there were many of them—she interpreted as "appointments befitting a noble knight," and as for the rooms themselves, she merely identified them with the rooms out of her own experience that they most closely resembled. Thus, the rec-hall became "the banquet hall," the supply room became "the kitchen," the control room became "the sorcerer's tower," the tourist compartments became "the sleeping tower," Mallory's bedroom-office became "the lord's quarters," the lavatory became "the chapel," and the generator room became "the dungeon." Only two things disconcerted her: the absence of servants and the fact that Easy Money was stabled in the banquet hall. Mallory got around the first by telling her that he had given the servants a leave of absence, and she herself got around the second by declaring it to be no more than fitting for such a splendid stead to be accorded special treatment. Certainly, Mallory reflected, she was nothing if she was not co-operative.

After showing her around he wasted no time in getting down to the business on hand, and stepping into the control room, he punched out the data necessary to take the *Yore* back to 7:15 p.m. of the same day, and to rematerialize it one half mile west of its present position, as an overlap was bound to occur. There was a barely noticeable tremor as the transition took place, and simultaneously the darkness showing on the control-room telewindow transmuted to dusk.

Turning away from the jump board, he saw Rowena regarding him with large eyes from the doorway. "We're now back to a point in time that precedes the theft of the Sangraal," he told her, "and we're relocated farther down the valley. But don't let it throw you. None other than Merlin himself built the magic apparatus you see before you in this room, and you know yourself that once he makes up his mind to it, Merlin can do anything."

She blinked once, but evinced no other sign of sur-

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prise. "Yea, fair sir," she said, "I am ware of the magic of Merlin."

"However," Mallory went on, "magic such as this isn't something for a gentlewoman such as yourself to fool around with, so I must forbid you to enter this room during my absence from the castle. Also, while we're on the subject, I must also forbid you to leave the castle during my absence. Merlin would be upset no end if there were two damosels that hight Rowena gallivanting around the countryside at the same time."

She blinked again. "By my troth, fair sir," she said, "I would lever die than disobey thy two commands." And then, "Have ye ate any meat late?"

This time, Mallory blinked. "Meat?"

"It is fitting that ye should eat meat afore ye ride out."

"Oh, you mean food. I'll eat when I get back. But there's no need for you to wait." He took her into the supply room and showed her where the vacuum tins were stored. "You open them like this," he explained, pulling one out and activating the desealer. "Then, as soon as the contents cool off a little, you sit down to dinner."

"But this be not meat," she objected.

"Maybe not, but it's a good substitute, and a lot better for you." A thought struck him, and he took her into the lavatory and showed her how to operate the hot- and cold-water dispenser, ascribing the setup to more of Merlin's magic. He debated on whether to explain the function and purpose of the adjacent shower, decided not to. There was a limit to all things, and an apparatus for washing one's whole body was simply too farfetched for anyone living in the sixth-century to take seriously.

Back in the rec-hall, he donned his helmet and gauntlets, reset the gauntlet timepiece, picked up his spear and encephalopathed Easy Money to his side. Mounting, he set the spear in the stirrup socket. Rowena gazed up at him, plum-blue eyes round with awe and admiration—and concern. "Wit ye well, fair sir," she said, "that Sir Launcelot, the which is thy father, is a knight of many victories, and therefore ye must take care."

Mallory grinned. "Dismay you not, fair damsel, I'll smite him from his steed before he can say 'Queen Guinevere'." He straightened his sword belt, activated the *Yore's* lock, and rode across the mirage-moat and entered the forest. The "portcullis" closed behind him.

Dusk had become darkness by the time he reached the highway. Approximately half an hour later he would reach the highway again. However, the seeming paradox did not disconcert him in the least: this was far from being the first time he had backtracked himself on a job.

As "before," he spurned the shadows of the bordering oaks and beeches and encephalopathed Easy Money to keep to the center of the lane. And, as "before," no

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one was abroad. Probably King Pelles' wassail was already in progress, or, if not, the goodly knights and gentlewomen were still at evensong. In any event, he reached the lane that led to the castle of Carbonek without mishap.

After entering the lane, he encephalopathed Easy Money into the concealment of the shadows of the bordering trees and settled back in the saddle to wait. Rowena's placing the time of the theft at "a little while afore eight of the clock" had been a general estimate at best; hence he had allowed himself plenty of leeway and had arrived on the scene a little early. It was well that he had, for hardly a minute passed before he heard hoofbeats approaching from the south, and presently he saw a tall knight astride a resplendent steed turn into the lane. His armor gleamed in the moonlight and bespoke a quality and class that only a knight of Sir Launcelot's status would be able to afford.

Mallory watched him ride down the lane to the lion-flanked entrance and heard him announce himself as "Sir Launcelot". The portcullis was raised without delay, and the knight rode through the gateway and disappeared from view.

Mallory frowned in the darkness. Something about the incident had failed to jibe. He thought back, but he could isolate nothing that, in retrospect anyway, seemed in the least incongruous. He tried again, with the same result, and at length he concluded that the note of discord had originated in his imagination.

Again, he settled back to wait. He wasn't particularly worried about the outcome of the forthcoming encounter—the superiority of his weapons and armor should be more than enough to see him through—but just the same he wished there was some way to avoid it. There wasn't, of course. Sir Launcelot's theft of the Sangraal was already incorporated in fact, and, as a *fait accompli,* could not be obviated by a previous theft. All Mallory could do was to make his move after the *fait accompli* in the hope that that was when he *had* made his move. A time-thief didn't have nearly as much leeway as his seeming freedom of movement might lead the uninitiated to believe. About all he could do was to play along with destiny and await his opportunities. If destiny smiled, he succeeded; if destiny frowned, he did not. However, Mallory was optimistic about his forthcoming bid for the Grail, for if it wasn't in the books for him to wrest the Cup from Sir Launcelot, the chances were he wouldn't have gotten as far as he had.

He estimated that it would take the man five minutes to enter the castle, proceed to the chamber, seize the Sangraal, return to the courtyard and come riding back to the portcullis. Seven minutes proved to be nearer the mark. In response to a hail from within the wall, several of the warders bent to the windlass, whereupon the portcullis scraped and groaned aloft, and the tall knight came riding out just as the hands of Mallory's timepiece registered 7:43 p.m.

Mallory let him pass, straining his eyes in vain for a glimpse of the Sangraal. He waited till Sir Launcelot was half a hundred yards down the highway before he encephalopathed Easy Money to follow, and he waited till a bend in the road hid the castle of Carbonek from view before encephalopathing the command to charge. At this point, Sir Launcelot became aware that he was no longer alone, and wheeled his steed around. Without an instant's hesitation, he dressed his spear and launched a counter-charge. All Mallory could think of was a twentieth-century steam locomotive bearing down upon him.

He swallowed grimly, "aventred" his own spear, and upped Easy Money's pace. Two could play at being locomotives. The approaching knight and steed loomed larger; the sound of hoofbeats crescendoed into staccato thunder. The spear pointing straight toward Mallory's breastplate had something of the aspect of a jet-propelled flagpole. Hurriedly, he got his shield into position. Maybe the man would spot the red cross, realize its significance, and slow down.

If he spotted it, he gave no sign, and only came the faster. Mallory braced himself for the forthcoming impact. However, the impact never occurred. At the last moment his antagonist directed the spearpoint at Mallory's helmet, did something that made it separate itself from the shaft to the accompaniment of a gout of incandescence and come streaking through the air like a little comet. Mallory tried to dodge, but he would have been equally as successful if he had tried to dodge a real comet. There was a deafening *clang!* in the region of his left audio-amplifier, and the whole left side of his face went numb. Just before he blacked out he saw the oncoming knight veer his steed, wheel it around, and ride off. A peal of all-too-familiar laughter drifted back over the man's shoulder.

"Now," said the rent-a-robogogue, "you will try again: 'A' is for 'Atom', 'B' is for 'Bomb', 'C' is for 'Conform', 'D' is for 'Dollar, 'E' is for 'Economy', and 'F' is for 'Fun'. What comes after 'F'?"

The boy Mallory squirmed in his ABC chair. "I don't know what comes next and I don't care!"

"I'll box your ears," the rent-a-robogogue threatened.

"You wouldn't dare!"

"Yes I would—I'm a physical-chastisement model, you know. Now, we'll try once more: 'A' is for 'Atom', 'B' is for 'Bomb', 'C' is for 'Conform', 'D' is for 'Dollar', 'E' is for 'Economy', and 'F' is for 'Fun'. What comes after 'F'?"

"I told you that I didn't know and that I didn't care!"

"I warned you," said the rent-a-robogogue.

"Ow!" the boy Mallory cried.

"Ow!" the man Mallory groaned, sitting up in the weeds beside the early sixth-century highway.

All was silence around him, if you discounted the stridulations of insects and the *be-ke korak-korak-korak* of frogs. A few yards away, Easy Money stood immobile

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in the moonlight. Mallory raised his hand to his helmet and felt the sizable dent that the spearpoint had made. Gingerly, he took the helmet off. Who in the world would have dreamed that they had jet-rifles in this day and age!

The absurdity of the thought snapped him back to full awareness. A moment later he remembered the peal of familiar laughter.

Perfidion!

The man must have wanted the Grail desperately to have come after it himself, which meant that it was probably worth much more than he had let on. But how had he known when and where to essay the lift? More specifically, how had he found out when and where to essay the lift on such short notice?

Mallory thought back. He was reasonably certain that he had made no slips of the tongue during his visit to the Perfidion Tower and during the ensuing game of golp, and he was equally certain that he had let fall no revealing references to the place-time he had so carefully pinpointed. Where, then, had he gone astray?

Suddenly, way back in his mind, Perfidion said, "By the way, Tom, I take it you're all set as regards costume, equipment and the like."

"I've got the sweetest little suit of armor you ever laid eyes on," Mallory heard himself answer.

He swore. So that was it! All Perfidion had needed to do was to make the rounds of the costumers who specialized in armor, and to shell out a few Kennedees to the one Mallory had patronized last. Then, in possession of the knowledge that Mallory was embarking into the past as Sir Galahad, all Perfidion had had to do was to consult one of the many experts he kept at his beck and call. The expert had undoubtedly told him where Sir Galahad was supposed to have found the Grail before taking it to Sarras, and, equally as important, approximately when the event was supposed to have taken place. Further questions could not have failed to elicit the additional information that Sir Launcelot had come to the chamber of the Sangraal before Sir Galahad had, and from this Perfidion had undoubtedly deduced that Sir Launcelot could very well have been a time-thief in disguise, too, and that the man, having arrived on the scene first, could very well have been responsible for the Grail's so-called return to Heaven, despite what legend said to the contrary. Certainly it had been a gamble worth taking, and obviously Perfidion had taken it.

And won the jackpot.

But that didn't mean he was going to keep the jackpot. Not by a long shot. Mallory encephalopathed Easy Money to his side and pulled himself to his feet with the help of the left stirrup and hung his helmet on the pommel. Then he picked up his spear and clambered into the saddle. "We're not beat yet, Easy Money," he said. *Giddyap!*

Easy Money whinnied, stamped its feet, and started back toward the *Yore*. A short while later they passed the lane that led to the castle of Carbonek. Presently Mallory heard the *clip-clop* of approaching hoofbeats, and not wanting to risk an encounter in his weakened condition, he encephalo-guided the rohorse off the highway and into the deep shadows of a big oak. There was something tantalizingly familiar about the horse and rider coming down the highway. Small wonder: the "horse" was Easy Money and the rider was himself. He was on his way to the castle of Carbonek to lift the Holy Grail.

Mallory gazed after his retreating figure disgustedly. "Sucker!" he said.

IV

Rowena nearly threw a fit when Mallory rode into the rec-hall. "Oh, fair knight, ye be sorely wounded indeed!" she cried, helping him down from his rohorse. "Certes, an ye bleed so much ye may die!"

Mallory's head was throbbing, and he saw two damosels that hight Rowena instead of only one. "I'll be all right after I lie down for a while," he said. "And don't worry about the bleeding—it's almost stopped."

He took a step in the direction of his bedroom office, staggered and would have fallen if she hadn't caught his arm. Her strength astonished him: for all the lightness of his armor, it still lent him an over-all weight of some two hundred and ten pounds; and yet the shoulder which she provided for him to lean on did not give once all the way to his bedside. She had his pauldrons, breastplate, and arm-coverings off in no time flat. His cuisses, greaves, and sollerets followed. The last he remembered was lying there in his under garments and his chainmail vest with three faces swimming in the misted sea of his vision, each of them invested with the peculiar beauty that concern, and concern alone, can grant.

"How is mammakin's little man now?" the rent-a-mammakin asked, applying soothing sedasalve to the boy Mallory's swollen ear.

"He hit me, mammakin," the boy Mallory sobbed. "Just because I wouldn't tell him that 'G' stands for 'Geography'. I hate geography! I hate it, hate it, hate it!"

"Nasty old rent-a-robogogue! Mammakin sent him away. He was an old model that got rented out by mistake. Is mammakin's little man's ear all right now?"

The boy Mallory sat up. "I want my real—" he began.

The man Mallory sat up. "I want my real—" he began.

"I have great joy of thy swift recovery, fair sir," Rowena said.

She was perched on the edge of his bed, applying a cool and soothing ointment to his ear. On the table by the bed lay a basin of water, and on her lap lay a pink tube. He grabbed the tube, looked at the label. *Sedasalve.* He sighed with relief. "Where did you find it?" he asked.

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"La! fair sir, when ye did seem no longer on live I did run both toward and forward in the castle seeking a magical salve whereby I might succor ye, whereupon I did come to a white box in the chapel wherein lay many magical tubes of diverse colors and natures whereof I did choose one and—"

Mallory was incredulous. "You chose a tube at random?" he demanded. "Good Lord, it might have contained a counteragent that could have killed me!"

"The . . . the letters thereon seemed of a magical nature, fair knight. And . . . and the color was seemly."

"Well anyway it was the right one." He looked at her. Could she read? he wondered. He was tempted to ask her, but refrained for fear of embarrassing her. "In that same white box," he said, "you will find a big bottle filled with round red pellets. Would you get it for me?"

When she returned with it, he took two of the pills, then he laid his head back on the pillow. "They'll restore the blood I lost," he explained, "but in order for them to do the job properly I've got to lie perfectly still for at least one hour."

She sat down on the edge of the bed. "Marry! the magic of Merlin is marvelous, albeit not as marvelous as the magic of Joseph of Arimathea."

"What did he do that was so marvelous?"

The plum-blue eyes were fixed full upon his face. "Ye wit naught of the tale of the white shield ye bear, fair sir? List, and I will tell ye:

"It befell after the passion of our Lord thirty-two year, that Joseph of Arimathea, the gentle knight, the which took down our Lord off the holy Cross, at that time departed from Jerusalem with a great party of his kindred with him. And so he labored till that they came to a city that hight Sarras. And at that same hour that Joseph came to Sarras there was a king that hight Evelake, that had great war against the Saracens, and in especialy against one Saracen, the which was King Evelake's cousin, a rich king and a mighty, which marched nigh this land, and his name was called Tolleme la Feintes. So on a day these two met to do battle. Then Joseph, the son of Joseph of Arimathea, went to King Evelake and told him he should be discomfit and slain, but if he left his belief of the old law and believed upon the new law. And then there he showed him the right belief of the Holy Trinity, to the which he agreed unto with all his heart; and there this shield was made for King Evelake, in the name of Him that died upon the Cross. And then—"

"Hold it a minute," Mallory said. "This shield you've finally got around to mentioning—is it the same one you set out to tell me about?"

"Wit ye well, fair sir. And then through King Evelake's good belief he had the better of King Tolleme. For when Evelake was in the battle there was a cloth set afore the shield, and when he was in the greatest peril he left put away the cloth, and then his enemies saw a figure of a man on the Cross, wherethrough they all were discomfit. And so it befell that a man of King Evelake's was smitten his hand off, and bare that hand in his other hand; and Joseph called that man unto him and bade him go with good devotion touch the Cross. And as soon as that man had touched the Cross with his hand it was as whole as ever it was tofore. Then soon after there fell a great marvel, that the cross of the shield at one time vanished away that no man wist where it became. And then King Evelake was baptized, and for the most part all the people of that city. So, soon after Joseph would depart, and King Evelake would go with him whether he would or nold. And so by fortune they came into this land, that at that time was called Great Britain: and there they found a great felon paynim, that put Joseph into prison. And so—"

"A great *what?*" Mallory asked. In one sense the story was familiar to him, but what bothered him was the fact that it was familiar in another sense too—a sense he couldn't put his finger on.

"A wicked unbeliever in our Lord. And so by fortune tidings came unto a worthy man that hight Mondrames, and he assembled all his people for the great renown he had heard of Joseph; and so he came into the land of Great Britain and disinherited this felon paynim and consumed him; and therewith delivered Joseph out of prison. And after that all the people were turned to the Christian faith.

"Not long after that Joseph was laid in his deadly bed. And when King Evelake saw that he made much sorrow, and said: For thy love I have left my country, and sith ye shall depart out of this world, leave me some token of yours that I may think on you. Joseph said: That will I do full gladly; now bring me your shield that I took you when ye went into battle against King Tolleme. Then Joseph bled at the nose, so that he might not by no means be staunched. And there upon that shield he made a cross of his own blood. Now may ye see a remembrance that I love you, for ye shall never see this shield but ye shall think on me, and it shall be always as fresh as it is now. And never shall man bear this shield about his neck but he shall repent it, unto the time that Galahad, the good knight, bare it; and the last of my lineage shall have it about his neck, that shall do many marvelous deeds. Now, said King Evelake, where shall I put this shield, that this worthy knight may have it? Ye shall leave it there as Nacien, the hermit, shall be put after his death; for thither shall that good knight come the fifteenth day after that he shall receive the order of knighthood: and so . . ."

When Mallory awoke, Rowena's head was resting on his chest, and she was breathing the soft and even breaths of untroubled sleep. Her hair, viewed thus closely, was not as dark as he had at first believed it to be. It was brown, really, rather than dark-brown. And astonishingly lustrous. Without thinking, he rested his hand lightly upon her head. She stirred then, and sat

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up, rubbing her plum-blue eyes. For a moment she stared at him uncomprehendingly, then, "Prithee forgive me, fair sir," she said.

Mallory sat up, too. "Forgive you for what? Go open a couple of vacuum tins while I get into my armor—I'm going to bring this caper to a close."

"Thy . . . they strength has returned?"

"I never felt better in my life."

In the rec-hall he said, sitting down at the table before one of the two vacuum tins she had opened, "You never did ask me what happened."

"Ye will tell me of thy own will an ye wish me to know."

Mallory took a mouthful of simulsteak, chewed and swallowed. "Your Sir Launcelot turned out to be a phony, and pulled a rabbit out of his helmet the nature of which I'd better not try to describe to you."

Eyes round as plums, she regarded him across the table. "A . . . a phony, fair sir?"

Mallory nodded. "That's a sort of felon paynim who plays golp."

"But with my own eyes I did see his armor, fair knight."

"That's right—you saw his armor. But you didn't see him. A certain character by the name of Perfidion was residing behind that hardware—not the good Sir Launcelot."

"Perfidion?"

Mallory grinned. "Sir Jason Perfidion—a knight errant ye wit not of. But the tournament's not over yet, and this time *I've* got the rabbit: he thinks I'm dead."

"He . . . he left ye for dead, fair sir?"

"That he did, and if that little brain-buster of his had struck just one inch to the right, I'd have been just that." He shoved his empty vacuum tin away and stood up. "Excuse me a minute—I've got to visit the sorcerer's tower again."

In the control room, he took the *Yore* back to 7:20 p.m. of the same day and re-materialized it half a mile farther down the valley. Turning, he saw that Rowena had followed him and was watching him from the doorway. "Whereabouts may I find oats that I may feed thy horse, fair knight?" she asked.

"Easy Money doesn't eat. He—" Mallory paused astonished as two of the largest tears he had ever seen coalesced in her eyes and went tumbling down her cheeks. "Oh, it's not that he's sick," he rushed on. "It's just that horses like him don't require food to keep them going. Why, Easy Money's guaranteed for . . . he'll live another thirty years."

The sun came up beyond the plum-blue horizons of her eyes. "It pleaseth me mickle to hear ye speak thus, fair knight. I . . . I have great joy of him."

Back in the rec-hall, Mallory pulled on his gauntlets, reset his timepiece, and donned his helmet. The left audio-amplifier was shot, but otherwise the piece was in good condition—aside from the dent, of course. He encephalopathed Easy Money to his side, hung his shield around his neck, and mounted. "Hand me my spear, will you, Rowena?" he asked.

She did so. "Ye be a most noble knight indeed, fair sir," she said, "for to set so little store by thine own life in the service of a damosel the which is undeserving of thy deeds. I . . . I would lever that ye forsook the Sangraal than that ye be fordone."

Her concern touched him, and he removed his helmet and leaned down and kissed her on the forehead. "Keep the home fires burning," he said; then, setting his helmet back in place, he activated the lock, rode across the mirage-moat, and set forth into the forest once again.

V

This time when he reached the crest of the ridge that separated the two valleys, Mallory took an azimuth on the towers of Carbonek, encephalo-fed the direction to Easy Money, and programmed the "animal" to proceed in as straight a course as possible.

In the east, the moon was just beginning to rise; in the west, traces of the sunset lingered blood-red just above the horizon. On the highway below, a knight sitting astride a brown rohorse and bearing a white shield with a red cross in the center was riding toward Carbonek to challenge a twenty-second century "felon paynim" in imitation Age-of-Chivalry armor. In the valley Mallory had just left behind him there were two castles named *Yore*, and soon, a third would pop into existence and yet another Mallory come riding out. Mallory grinned. It was a little bit like playing chess.

The forest which Easy Money presently entered was parklike in places, and sometimes the trees thinned out into wide, moonlit meadows. Crossing one of the meadows, Mallory saw the first star, and when at length Easy Money emerged on the highway, the heavens were decked out in typical midsummer panoply. The rohorse had followed its programming almost perfectly and had emerged at a point just south of the lane leading to the castle of Carbonek. All Mallory had to do was to encephalo-guide it farther down the highway to a point beyond the site of the forthcoming joust. While doing so, he kept well within the concealing shadows of the bordering oaks and beeches where the ground was soft and could give forth no telltale *clip-clop* of hoofbeats. His circumspection proved wise—as in one sense, of course, it already had—and when the false Sir Launcelot came riding by on his way to the castle and the chamber of the Sangraal, he was no more aware of Mallory III's presence by the roadside than he would presently be aware of Mallory II's presence in the shadows of the trees that bordered the lane.

Mallory III grinned again and brought Easy Money to a halt just beyond the next bend. "Wit ye well, Sir Jason, that thy hours be numbered," he said.

He remained seated in the saddle, feeling pretty good

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about the world. In no time at all, if his one-man ambuscade came off, he would be on his way back to the *Yore*, and thence to the twenty-second century and a haircut. Selling the Sangraal without the aid of a professional time-fence like Perfidion would be difficult, of course, but it could be done, and once it was done, he, Mallory, could take his place on Get-Rich-Quick Street with the best of them, and no questions would be asked. There was, to be sure, the problem of what to do about a certain damosel that hight Rowena, but he would face that when he came to it. Maybe he could drop her off a dozen years in the future in a region far enough removed from Carbonek to ensure her safety. He would see.

At this point in his reflections he was jolted into alertness by the sound of approaching hoofbeats. A moment later he heard a second set of hoofbeats and knew that Mallory II had made his presence known. Presently both sets crescendoed into staccato thunder as the two "knights" came pounding toward each other, and not long afterward there was a clank and a clatter as Mallory II went tumbling out of his saddle and into the roadside weeds. Finally the single set of hoofbeats took over again, and Mallory III saw a horse and rider coming around the bend in the highway. He braced himself.

Before making his play, he waited till horse and rider were directly opposite him; then he encephalopathed Easy Money to charge. "Sir Launcelot" managed to get his shield up in time, but the maneuver did him no good. Mallory's spearhead struck the shield dead center, and "Sir Launcelot" went sailing out of his saddle to land with an awesome clatter flat on his back on the highway. He did not get up.

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Dismounting, Mallory removed the man's helmet. It was Perfidion all right. There was a large bruise on the side of his head and he was out cold, but he was still breathing. Next, Mallory looked for the Sangraal. Perfidion had concealed it somewhere, and apparently he had done the job well. Since the armor could not have accommodated an object of that size, the hiding place had to be somewhere on the body of his horse. The horse was standing quietly beside Easy Money in the middle of the highway. It was jet-black and its fetlock-length trappings were blue, threaded with silver; otherwise, the two steeds were identical. Mallory tumbled to the truth then, went over to where the black "horse" was standing, raised its trappings, found the tiny activator button, and depressed it. The croup-hood rose up, and there in the secret compartment, wrapped in red samite, lay the cause of the mounting absentee-rate in King Arthur's court.

Always the skeptic, Mallory raised a corner of the samite in order to make certain that he was not being cheated. Instantly, a reflected ray of moonlight stabbed upward into his eyes, and for a moment he was blinded. Exorcising the thought that sneaked into his mind, he closed the croup-hood, rearranged the trappings, and returned to Perfidion's side. Dragging the armor-encumbered man over to the black rohorse and slinging him over the saddle was no easy matter, but Mallory managed; then he picked up Perfidion's helmet and spear and set the former on the pommel and wedged the latter in one of the stirrups. Finally he mounted Easy Money and, encephalopathing the black rohorse to follow, set out down the highway away from the castle of Carbonek.

Make-believe castles could fool the hadbeens, but they couldn't fool a professional. He spotted the phony towers of Perfidion's TSB rising above the trees before he had proceeded half a mile. After raising the "portcullis", he got the man down from the black rohorse, dragged him inside, and propped him against the rec-hall bar. Then he got the man's helmet and spear and laid them beside him. After considerable reflection, he went into the control room, set the time-dial for June 10, 1964, the space-dial for a busy intersection in downtown Los Angeles, and punched out H-O-T-D-O-G S-T-A-N-D on the lumillusion panel. Satisfied, he went into the generator room and short-circuited the automatic throw-out unit so that when rematerialization took place, the generator would burn up. Finding a ball of heavy-duty twine, he returned to the control room, tied one end to the master switch, and began backing out of the TSB, unwinding the twine as he went.

In the rec-hall, he paused, and grinned down at the still-unconscious Perfidion. "It's a better break than you meant to give me, Jason," he said. "And don't worry—once you explain to the authorities what you're doing in a suit of sixth-century armor and how you happened to open a giant hot-dog stand in the middle of a traffic-clogged crossroads, you'll be all right. As a matter of fact, with your knowledge of things to come, you'll probably wind up a richer man than you are now—if the smog doesn't get you first." He stepped through the lock, jerked the twine, and the "castle" vanished into thin air.

Remounting Easy Money and encephalopathing the black rohorse to follow, he started back toward the *Yore*, taking a direct route through the forest. He was halfway to his destination and had just emerged into a wide meadow when he saw the knight with the white shield riding toward him in the bright moonlight. In the center of the shield there was a vivid blood-red cross.

When the knight saw Mallory, he brought his steed to a halt. Moonlight glimmered eerily on his shield, turned his helmet to silver. His armor seemed to emit an unearthly light—a light that was at once terrifying and transcendent. The hilt of his sword was as blood-red as the cross on his shield; so was the pommel of his spear. Here was righteousness incarnate. Here in the form of an armored man on horseback was the quintessence of the Age of Chivalry—not the Age of Chivalry as exemplified by the vain and boasting nobles who had constituted nine-tenths of the knight-errantry profession and who had used the quest of the Holy Grail as an excuse to seek after mead and maidens, but the Age of Chivalry as it might have been if the ideal behind it had been shared by the many instead of by the few; the Age of Chivalry, in short, as it had come down to posterity through the pages of Malory's *Le Morte d'Arthur*.

At length the knight spoke: "I hight Sir Galahad of the Table Round."

Reluctantly, Mallory encephalopathed his two rohorses to halt, and said the only thing he had left to say: "I hight Sir Thomas of the castle *Yore*."

"By whose leave bear ye likenesses of the red arms and the white shield whereon shines the red cross the which was put there by Joseph of Armathea whilst he lay dying in his deadly bed?"

Mallory did not answer.

There was a silence. Then, "I would joust with ye," Sir Galahad said.

There it was, laid right on the line. The challenge—The death sentence.

Nonsense! Mallory told himself. He's nothing but a nineteen-year old kid. With your rohorse and your superior weapons you can unseat him in two seconds flat, and once he's down, that glorified junk pile he's wearing will glue him to the ground so fast he won't be able to lift a finger!

Aloud, he said, "Have at me then!"

Instantly, Sir Galahad wheeled his horse around and rode to the far side of the meadow. There, he wheeled the horse around again and dressed his spear. Moonlight danced a silvery saraband on his white shield, and the blood-red cross blurred and seemed to run.

Mallory dressed his own spear. Immediately, Sir

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Galahad charged. *Full speed ahead, Easy Money!* Mallory encephalopathed, and the rohorse took off like a rocket.

All he had to do was to hang on tight, and the joust would be in the bag, he reassured himself. Sir Galahad's spear would break like a matchstick, while his own superior spear would penetrate Sir Galahad's shield as though the shield was made of tissue paper, as in a sense it really was when you compared the metal that constituted it to modern alloys. No matter how you looked at the situation, the kid was in for a big letdown. Mallory almost felt sorry for him.

The hoofbeats of horse and rohorse crescendoed; there was the resounding *clang!* of steel coming into violent contact with steel. Mallory's spear struck Sir Galahad's shield dead center—and snapped in two. Sir Galahad's spear struck Mallory's shield dead center—and Mallory sailed over Easy Money's croup and crashed to the ground.

He was stunned, both mentally and physically. Staggering to his feet, he drew his sword and raised his shield. Sir Galahad had wheeled his horse around, and now he came riding back. Several yards from Mallory, he tossed his spear aside, dismounted as lightly as though he wore no armor at all, drew his sword, and advanced. Mallory stepped forward, his confidence returning. His spear had been defective—that was it. But his sword and his shield weren't, and now that the kid had elected to give him a sporting chance, he would teach the young upstart a lesson that he would never forget.

Again, the two men came together. Down came Sir Galahad's sixth century sword; up went Mallory's twenty-second century shield. There was an ear-piercing *clang*, and the shield parted down the middle.

Aghast, Mallory stepped back. Sir Galahad moved in, sword upraised again. Mallory raised his own sword, caught the full force of the terrific down-rushing blow on the blade. His sword was cut cleanly in two, his left pauldron was cleanly cleaved, and a great numbness afflicted his left shoulder. He went down.

He stayed down.

Sir Galahad leaned over him, unbroken sword uplifted. The cross in the center of the snow-white shield was a bright and burning red. "Ye must yield you as an overcome man, or else I may slay you."

"I yield," Mallory said.

Sir Galahad sheathed his sword. "Ye be not sorely wounded, and sithen I desire not neither of they two steeds, as belike they be as unworthy as they pieces, ye can return to thy castle unholpen."

Mallory blacked out for a moment, and when he came to, the shining knight was gone.

He lay there in the moonlight for some time, looking up at the stars. At length he fought his way to his feet and encephalopathed the two rohorses to his side. Mounting Easy Money, he encephalopathed it to return to the westernmost "castle of Yore" and encephalopathed the other rohorse to follow. He left his broken weapons where they lay.

What had gone out of the world during the last sixteen hundred years that had left sophisticated twenty-second century steel inferior in quality to naïve sixth-century wrought iron? What did Sir Galahad have that he, Mallory, lacked? Mallory shook his head. He did not know.

The moonlit "towers" of the *Yore* had become visible through the trees before it occurred to him that before riding away the man just might have removed the Sangraal from the black rohorse's croup. At first thought, such a possibility was too absurd to be entertained, but not on second thought. According to *Le Morte d'Arthur*, the fellowship of Sir Galahad, Sir Percivale, and Sir Bors had taken both the table of silver and the Sangraal to Sarras where, some time later, the Sangraal had been "borne up to heaven", never to be seen again. Whether they had taken the table of silver did not concern Mallory, but what did concern him was the fact that if they had taken the Sangraal they could have done so only if it had fallen into Sir Galahad's hands this very night. Tomorrow would be too late—now was too late, in fact—provided, of course, that Mallory was destined to return with it to the twenty-second century. Here, then, was the crossroads, the real moment of truth: was he destined to succeed, or wasn't he?

Hurriedly, he encephalopathed the two rohorses to halt, dismounted, and raised the black rohorse's trappings. He was dizzy from the loss of blood, but he did not let his dizziness dissuade him from his purpose, and he had the croup-hood raised in a matter of a few seconds. He held his breath when he looked within, expelled it with relief. The Sangraal had not been disturbed.

He lifted it out of the croup-compartment, straightened its red samite covering, and cradled it in his arms. Too weak to remount Easy Money, he encephalopathed the two rohorses to follow and began walking toward the *Yore*. Rowena must have seen him coming on one of the telewindows, for she had the lock open when he arrived. Her face went white when she looked at him, and when she saw the Grail, her eyes grew even larger than plums. He went over and set it gently down on the rec-hall table, then he collapsed into a nearby chair. He had just enough presence of mind left to send her for the bottle of blood-restorer pills, and just enough strength left to swallow several of them when she brought it. Then he boarded the phantom ship that had mysteriously appeared beside him and set sail upon the soundless sea of night.

VI

"No," said the rent-a-mammakin, "you cannot see

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her. She is displeased with your score in the get-rich-quick race."

"I did my best," the boy Mallory sobbed. "But when it came to stepping on all those faces, I just couldn't do it!"

The rent-a-mammakin arranged its features into a severe frown and strengthened its grip on the boy Mallory's arm. "You knew that they were only painted on the game floor to symbolize the Competitive Spirit," it said. "Why couldn't you step on them?"

The boy Mallory made a final desperate effort to gain the bedroom door which his mother had just slammed and before which the rent-a-mammakin stood, then he sank defeated to the floor. "I don't know why—I just couldn't, that's all," he sobbed. He raised his voice. "But I *will* step on them! I'll step on real faces too—just you wait and see. I'll be a bigger get-rich-quickman than my father ever dreamed of being. I'll show her!"

"I'll show her," the man Mallory murmured, "just you wait and see."

He opened his eyes. Save for himself, the bedroom-office was empty. "Rowena?"

No answer.

He raised his voice. "Rowena!"

Again, no answer.

He frowned. The door to the bedroom-office was open, and the "castle" certainly wasn't so large that his voice couldn't carry from one end of it to the other.

His shoulder throbbed faintly, but otherwise he was unaware of his wound. Rowena had bound it neatly—it was said that Age-of-Chivalry gentlewoman were quite proficient in such matters—and apparently she had once again got hold of the right counteragent.

He sat up and swung his feet to the floor. So far, so good. Tentatively, he stood up. A wave of vertigo broke over him. After it passed, he was as good as new. The blood-restorer pills had done their work well.

Nevertheless, everything was not as it should be. Something was very definitely wrong. "Rowena!" he called again.

Still no answer.

She had removed his armor and piled it neatly at the foot of the bed. He stared at the various pieces, trying desperately to think. Something had awakened him—that was it. The slamming of a door . . . or a lock.

He took a deep breath. He smelled green things. Dampness. A forest at eventide . . .

He knew then what was wrong. The lock of the *Yore* had been opened and had been left open long enough for the evening air to permeate the interior of the TSB; long enough, in other words, to have permitted someone to ride acrôss the imaginary drawbridge that spanned the mirage-moat. Afterward, the lock had slammed back into place of its own accord.

He hurried into the rec-hall. Easy Money stood all alone behind the tourist-bar. The black rohorse was gone.

His eyes leaped to the rec-hall table. The Sangraal was gone, too.

He groaned. The little idiot was taking it back! And after he had forbidden her to leave the "castle" too! Well no, he hadn't forbidden her exactly: he had forbidden her to leave it *during his absence.*

He walked over to the telewindow nearest the lock and scrutinized the screen. She was nowhere in sight, but night was on hand and the range of his vision, while considerably abetted by the light of the rising moon, was limited to the nearer trees.

Presently he frowned. Was it still the same night, or had he been unconscious for almost twenty-four hours?

It *couldn't* be the same night—the position of the moon disproved that. And yet he could swear that he had been unconscious for no more than a few hours.

Belatedly, he remembered his gauntlet timepiece, and returned to the bedroom-office. The timepiece registered 10:32. But that didn't make any sense either: the moon was still low in the sky.

He knew then that there could be but one answer, and he headed for the control room posthaste. Sure enough, the jump-board timedial had been set for 8:00 p.m. of the same day. He looked at the space-dial. That had been set to re-materialize the *Yore* one half mile farther west.

He wiped his forehead. Good Lord, she might have sent the TSB all the way back to the Age of Reptiles! Even worse, she might have plunked it right down in the middle of WWIII!

She hadn't, though. In point of fact, she had done exactly what she had set out to do—taken the *Yore* back to a point in time from which the Sangraal could be returned to the castle of Carbonek less than an hour after it had been stolen.

Suddenly he remembered how she had watched him from the doorway of the control room each time he had reset the time- and space-dials. Technologically speaking, she was little more than a child, but jump-boards were as uncomplicated as modern technology could make them, and a person needed to be but little more than a child to operate them.

Grimly, Mallory returned to his bedroom-office and got into his armor; then, ignoring the throbbing of his reawakened wound, he mounted Easy Money and set out. He had no weapons, but it could not be helped. With a little luck, he would have need of none. He was about due for a little luck, if you asked him.

He gambled that Rowena would use the same route back to the chamber of the Sangraal that they had used in leaving it—actually, she had no other choice—and he encephalo guided Easy Money at a fast trot in the direction of the river in the hope of overtaking her before she reached the entrance to the subterranean passage. However, the hope did not materialize, and he saw no sign of her till he reached the entrance himself. Strictly speaking, he saw no sign of her then either, but he did

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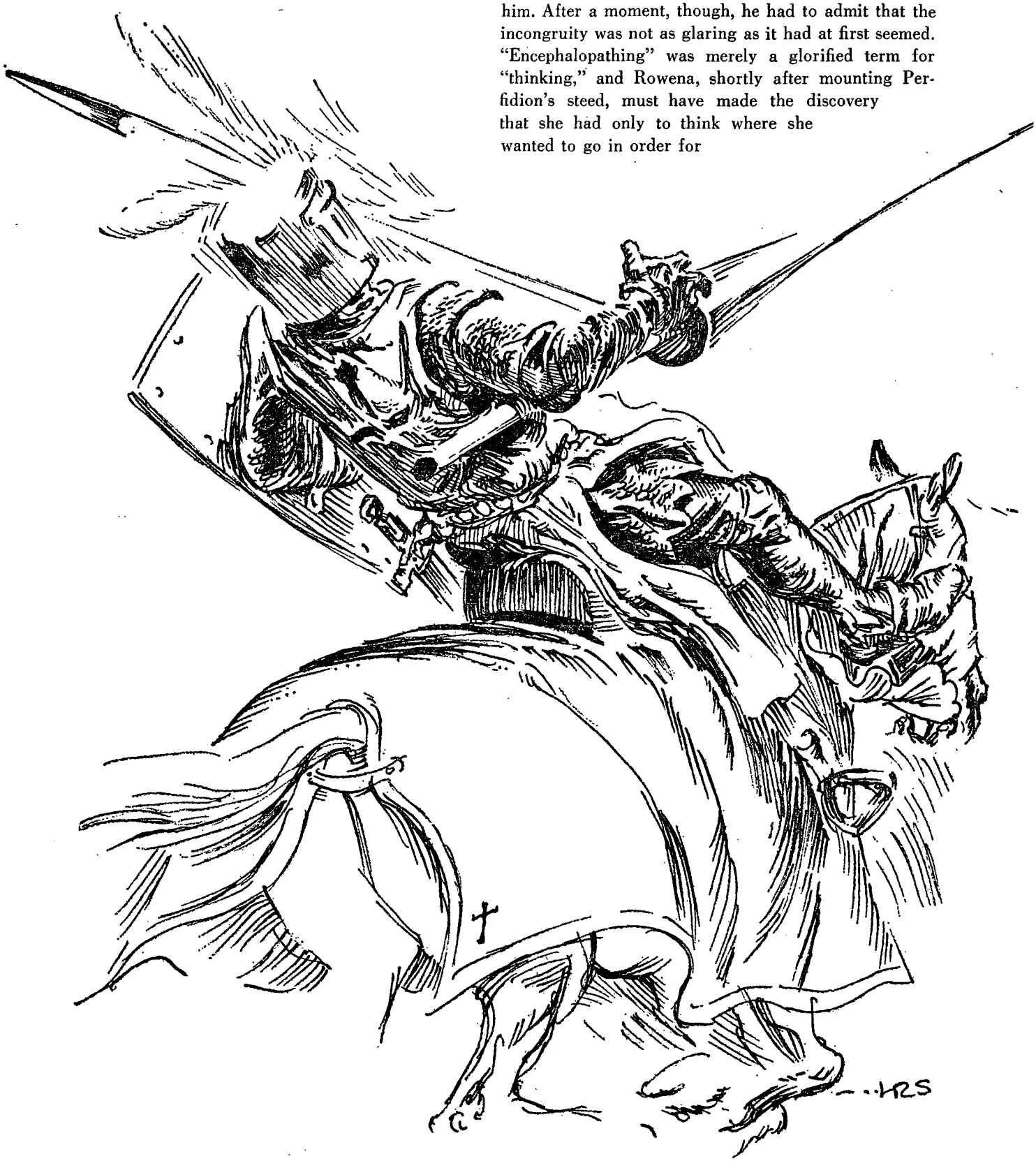
discern several dislodged stones that could have been thrown up by the black rohorse's hoofs.

Entering the passage, he frowned. Until that moment, the incongruity of a sixth-century damosel encephalo, guiding a twenty-second century rohorse had not struck him. After a moment, though, he had to admit that the incongruity was not as glaring as it had at first seemed. "Encephalopathing" was merely a glorified term for "thinking," and Rowena, shortly after mounting Perfidion's steed, must have made the discovery that she had only to think where she wanted to go in order for



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the rohorse to take her there.

He had not remembered to bring a light, nor did he need one. The infra-red rays of Easy Money's eye units were more than sufficient for the task on hand, and overtaking the girl would have been as easy as rolling off a log—if she hadn't been riding a rohorse, too. Overtaking her wasn't of paramount importance anyway: he could confiscate the Sangraal after she returned it just as easily as he could before.

The odd part about the whole thing was that Mallory never once thought of the inevitable overlap till he saw the flicker of torchlight up ahead. An instant later he heard the sound of a woman's voice, and instinctively he encephalo-guided Easy Money into a nearby shallow cave.

The flickering light grew gradually brighter, and presently hoofbeats became audible. The woman's voice was loud and clear now, and Mallory made out her words above the purling of the underground stream: ". . . And then he set down the maiden, and was armed at all pieces save he lacked his spear. Then he dressed his shield, and drew out his sword, and Bors smote him so hard that it went through his shield and habergeon

on the left shoulder. And through great strength he beat him down to the earth, and at the pulling of Bors' spear there he swooned. Then came Bors to the maid and said: How seemeth it to you of this knight ye be delivered at this time? Now sir, said she, I pray you lead me there as this knight had me. So shall I do gladly: and took the horse of the wounded knight, and set the gentlewoman upon him, and so brought her as she desired. Sir knight, said she, ye have better sped than ye weened, for an I had lost my maidenhead, five hundred men should have died for it. What knight was he that had you in the forest? By my faith, said she, he is my cousin. So wot I never with what engyn the fiend enchafed him, for yesterday he took me from my father privily; for I nor none of my father's men mistrusted him not, and if he had had my maidenhead he should have died for the sin, and his body shamed and dishonored for ever. Thus as . . ."

At this point, the truth behind the sense of *deja vu* that Mallory had experienced the first time he had heard the tale hit him so hard between the eyes that he jerked back his head. When he did so, his helmet came into contact with the cave wall and scraped against the stone. The rohorse and its two riders were directly across the stream now. "*Shhh!*" Mallory I whispered.

Rowena I gasped. "It were best that I thanked ye now for thy great kindness, fair knight," she said, "for anon we be no longer on live."

"Nonsense!" Mallory I said. "If this fiend of yours is anywhere in the vicinity, he's probably more afraid of us than we are of him."

"Per . . . peradventure he hath already had meat," Rowena I said hopefully. "The tale saith that an the fiend be filled he becomes aweary and besets not them the which do pass him by in peace."

"I'll keep my sword handy just in case he changes his mind," Mallory I said. "Meanwhile, get on with your autobiography—only for Pete's sake, cut it short, will you?"

"An it please, fair sir. Thus as the fair gentlewoman stood talking with Sir Bors there came twelve knights seeking after her, and anon . . ."

For a long while after the voices faded away, Mallory IV could not move. Hearing the story the second time and, more important, hearing it from the standpoint of an observer, he had been able to identify it for what it really was—an excerpt from *Le Morte d'Arthur*. The Joseph of Arimathea bit had been an excerpt, too, he realized now, probably lifted word for word from the text. It was odd indeed that a sixth-century damosel who presumably couldn't read could be on such familiar terms with a book that would not be published for another nine hundred and forty-three years.

But not so odd if she was a twenty-second century blonde in a sixth-century damosel's clothing.

Remembering Perfidion's secretary, Mallory felt sick. No, there was no noticeable resemblance between her

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and the damosel that hight Rowena; but the removal of a girdle and a quarter of a pound of makeup, not to mention the application of a "lustre-rich" brown hair-dye and the insertion of a pair of plum-blue contact lenses, could very well have brought such a resemblance into being—and quite obviously had. The Past Police were noted for their impersonations, and most of them had eidetic memories.

Come on, Easy Money, Mallory encephalopathed. *You and I have got a little score to settle.*

When he entered the chamber of the Sangraal, Rowena IV was arranging the red samite cover around the Grail. She jumped when she saw him. "Marry! fair sir, ye did startle me. Methinketh ye be asleep in thy castle."

"Knock it off," Mallory said. "The masquerade's over."

She regarded him with round uncomprehending eyes. He got the impression that she had been crying. "The . . . the masquerade, fair knight?"

"That's right . . . the masquerade. You're no more the damosel Rowena than I'm the knight Sir Galahad."

She lowered her eyes to his breastplate. "I . . . I wot well ye be not Sir Galahad, fair sir. It . . . it happed that aforetime I did see Sir Galahad with my own eyes, and when ye did unlace thy unberere and I did see thy face, I knew ye could not be him of which ye spake." Abruptly she raised her head and looked at him defiantly. "But I knew from thy eyes that ye be most noble, fair sir, and therefore an ye did pretend to be him the which ye were not, ye did so for noble cause, and it were not for me to question."

"I said knock it off," Mallory said, but with considerable less conviction. I'm onto you—don't you see? You're a time-fink."

"A . . . a time fink? I wot not what—"

"An agent of the Past Police. One of those do-gooders who run around history replacing stolen goods and turning in hard-working people like myself. You gave yourself away when you lifted that Sir Bors bit straight out of *Le Morte d'Arthur* and—"

"But I did say ye sooth, fair sir. Sir Bors did verily succor my maidenhead. I wot not how there can be two of ye and two of me and four hackneys when afore there were but two, and I wot not how by touching the magic board in thy castle in a certain fashion that I could make the hour earlier and I wot not how the magic steed I did bestride brought me hither—I wot not none of these matters, fair sir. I wot only that the magic of thy castle is marvelous indeed."

For a while, Mallory didn't say anything. He couldn't. In the plum-blue eyes fixed full upon his face, truth shone, and that same truth had invested her every word. The damosel Rowena, despite all evidence to the contrary and despite the glaring paradox the admission gave rise to, was not a phony, never had been a phony, and never would be a phony. She was, as a matter of fact—with the exception of Sir Galahad—the only completely honest person he had known in all his life.

"Tell me," he said, at length, "weren't you afraid to come back through that passage alone? Weren't you afraid the fiend would get you?"

"La! fair sir—I had great fear. But it were not fitting that I bethought me of myself at such a time." She paused. Then, "What might be thy true name, sir knight?"

"Mallory," Mallory said. "Thomas Mallory."

"I have great joy of thy acquaintance, Sir Thomas."

Mallory only half heard her. He was looking at the samite-covered Sangraal. No more obstacles stood between him and his quest, and time was a-wasting. He started to take a step in the direction of the silver table.

His foot did not leave the floor.

He was acutely aware of Rowena's eyes. As a matter of fact, he could almost feel them upon his face. It wasn't that they were any different than they had been before: it was just that he was suddenly and painfully cognizant of the trust and the admiration that shone in them. Despite himself, he had the feeling that he was standing in bright and blinding sunlight.

Again, he started to take a step in the direction of the silver table. Again, his foot did not leave the floor.

It wasn't so much the fact that she didn't believe he would take the Sangraal that bothered him: it was the fact that she couldn't conceive of him taking it. She could be convinced that black was white, perhaps, and that white was black, and that fiends hung out in empty caves and castles; but she could never be convinced that a "knight" of the qualities she imputed to Mallory could perform a dishonorable act.

And there it was, laid right on the line. For all the good the Grail was going to do Mallory, it might just as well have been at the bottom of the Mindanao Deep.

He sighed. His gamble hadn't paid off any more than Perfidion's had. The real Sir Galahad was the one who had inherited the Grail after all—not the false one. The false one grinned ruefully. "Well," he told the damosel Rowena, "it's been nice knowing you." He swallowed; for some reason his throat felt tight. "I . . . I imagine you'll be all right now."

To his amazement, she broke into tears. "Oh, Sir Thomas!" she cried. "In my great haste to return the Sangraal to the chamber and to right the grievous wrong committed by the untrue knight Sir Jason, I did bewray my trust again. For when I espied ye and me and Easy Money in the passage I did suffer a great discomfit, and it so happed that when my steed did enter into a cave that the Sangraal came free from my hands and . . . and—"

Mallory was staring at her. "You *dropped* it?"

Stepping over to the silver table, she lifted a corner of the red samite. The dent was not a deep one, but just the same you didn't have to look twice to see it. "I . . .

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I nyst not what to do," she said.

Suddenly Mallory remembered the first sound he had heard in the passage when he and Rowena were leaving the castle of Carbonek. "Well how do you like that!" he said. He grinned. "I take it that this puts your hands in jeopardy all over again—right?"

"Yea, Sir Thomas, but I would lever die than beseech thee again to—"

"Which," Mallory continued happily, "makes it out of the question for a knight such as myself to leave you behind." He took her arm. "Come on," he said. "I don't know how I'm going to fit a sixth-century damosel into twenty-second century society, but believe me, I'm going to try!"

"And . . . and will ye take Easy Money to this land whereof ye speak, Sir Thomas?"

"Sir Thomas" grinned. "Wit ye well," he said, "and his buddy, too. Come on."

In the *Yore,* he tossed his helmet and gauntlets into a corner of the rec-hall and proceeded straight to the control room. There, with Rowena standing at his elbow, he set the time-dial for June 21, 2178 and the space-dial for the Kansas City Time-Tourist Port. Lord, it would be good to get home again and get a haircut! "Here goes," he told Rowena, and threw the switch.

There was a faint tremor. "Brace yourself, Rowena," he said, and took her over to the control-room telewindow.

Together, they gazed upon the screen. Mallory gasped. The vista of spiral suburban dwellings which he had been expecting was not in the offing. In its stead was a green, tree-stippled countryside. In the distance, a castle was clearly discernible.

He stared at it. It wasn't a sixth-century job like Carbonek—it was much more modern. But it was still a castle. Obviously, the jump-board had malfunctioned and thrown the *Yore* only a little ways into the future, the while leaving it in pretty much the same locale.

He returned to the jump-board to find out. Just as he reached it, its lights flickered and went out. The time- and space-dials, however, remained illumined long enough for him to see when and where the TSB had rematerialized. The year was 1428 A.D.; the locale, Warwickshire.

Mallory made tracks for the generator room. The generator was smoking, and the room reeked with the stench of shorted wires.

He swore. Perfidion!

So that was why the man had broken with tradition and invited a common time-thief to a game of golp!

If he had been anyone but Perfidion he would have gimmicked the controls of the *Yore* so that Mallory would have wound up directly in the fifteenth century sans sojourn in the sixth. But being Perfidion, he had wanted Mallory to know how completely he was being outsmarted. The chances were, though, that if the man

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had anticipated the near-coincidence of the two visits to the chamber of the Sangraal he would have seen to it that Mallory had never gotten a chance to use his Sir Galahad suit.

Returning to the control room, Mallory saw that the lumillusion panel had been pre-programmed to materialize the *Yore* as a fifteenth-century English castle. Apparently it had been in the books all along for him to become a fifteenth-century knight, just as it had been in the books all along for Perfidion to become the proprietor of a misplaced hot-dog stand.

Mallory laughed. He had gotten the best of the bargain after all. At least there was no smog in the fifteenth century.

Who was he supposed to be? he wondered. Had his name gone down in history by any chance?

Abruptly he gasped. Was *he* the Sir Thomas Malory with estates in Northampshire and Warwickshire? Was *he* the Sir Thomas Malory who had compiled and translated and written *Le Morte d'Arthur?* Almost nothing about the man's life was known, and probably the little that was known had been assumed. He *could* have popped up from nowhere, made his fortune through foreknowledge, and been knighted. He *could* have been a reformed time-thief stranded in the fifteenth century.

But if he, Mallory, was Malory, how in the world was he going to get five hundred chapters of semi-historical data together and pass them off as *Le Morte d'Arthur?*

Suddenly he understood everything.

Going over to where Rowena was still standing in front of the telewindow, he said, "I'll bet you know no end of stories about the doings of the knights of the Table Round."

"La! Sir Thomas. Ever I saw day of my life I have heard naught else in the court of my father."

"Tell me," Mallory said, "how did this Round Table business begin? Or, better yet, how did the Grail business begin? We can take up the Round Table business later on."

She thought for a moment. Then, "List, fair sir, and I will say ye: At the vigil of Pentecost, when all the fellowship of the Round Table were come unto Camelot and there heard their service, and the tables were set ready to the meat, right so entered into the hall a full fair gentlewoman on horseback, that had ridden full fast, for her horse was all besweated. Then she there alit, and came before the king and saluted him; and he said: Damosel, God thee bless. Sir, said she, for God's sake say me where Sir Launcelot is. Yonder ye may see him, said the king. Then she went unto Launcelot and said: Sir Launcelot, I salute you on King Pelles' behalf, and I require you come on with me hereby into a forest. Then Sir Launcelot asked her with whom she dwelled. I dwell, said she, with King Pelles. What will ye with me? said Launcelot. Ye shall know, said she, when ye—"

"That'll do for now," Mallory interrupted. "We'll come back to it as soon as I get stocked up on paper and ink. Scheherazade," he added.

"Scheherazade, Sir Thomas? I wot not—"

He leaned down and kissed her. "There's no need for you to wot," he said. Probably, he reflected, he would have to do a certain amount of research in order to record the happenings that had ensued his and Rowena's departure, and undoubtedly said research would result ironically in the recording of the true visits of Sirs Galahad and Launcelot to the chamber of the Sangraal—the "time-slots" on which he and Perfidion had gambled and lost their shirts. The main body of the work, however, had been deposited virtually on his lap, and its style and flavor had been arbitrarily determined. Moreover, contrary to what history would later maintain, the job would not be done in prison, but right here in the "castle of Yore" with Rowena sitting—and dictating—beside him. As for the impossibility of giving a sixth-century damosel as his major source, that could be avoided—as in one sense it already had been—my making frequent allusions to imaginary French sources. And as for the main obstacle to the endeavor—his twenty-second century cynicism—that had been obviated during his encounter with Sir Galahad.

The book wouldn't be published till 1485, but just the same, he was keen to get started on it. Writing it should be fun. Which reminded him: "I know we haven't known each other very long in one sense, Rowena," he said, "but in another, we've known each other for almost nine hundred years. Will you marry me?"

She blinked once. Then her plum-blue eyes showed how truly blue they could become and she threw her arms around his gorget. "Wit ye well, Sir Thomas," said she, "that there is nothing in the world but I would lever do than be thy bride!"

Thus did the prose epic known
successively as "La Mort d'Arthur,"
THE MOST ANCIENT
AND FAMOUS HISTORY OF THE
RENOWNED PRINCE ARTHUR,
KING OF BRITAINE,
AS ALSO, ALL THE NOBLE ACTS,
AND HEROICKE DEEDS
OF HIS VALIANT KNIGHTS
OF THE ROUND TABLE,
and "Le Morte d'Arthur"
come to be recorded.

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NEW FOLKS' HOME

When a man grows old, and has outworn his usefulness to his society, they tend to want to park him somewhere out of their way. His society does, that is . . .

By CLIFFORD D. SIMAK

ILLUSTRATED BY JOHN SCHOENHERR

The house was an absurdity. What is more, it was out of place. And it had no right to be there, Frederick Gray told himself. For this was his country, his and old Ben Lovell's. They had discovered it almost forty years before and had come here ever since and in all that time there had been no one else.

He knelt in the canoe and stroked idly with the paddle to keep the craft in place, with the bright, brown autumn water flowing past, bearing on its surface little curls of foam from the waterfall a half a mile ahead. He had heard the faint thunder of the falls when he had parked the car and lowered the canoe from its top and for the past hour he'd traveled toward it, listening to it and storing the sound of it away, as he was storing everything away, for this, he knew, was the last trip to this place he would ever make.

They could have waited, he told himself, with a strange mellow bitterness. They could have waited until he had made the trip. For it was all spoiled now. No longer could he ever think upon this stream without the house intruding. Not as he had known the stream for almost forty years, but now always with the house.

No one had ever lived here. No one would want to live here. No one ever came here. It had been his and Ben's alone.

But the house stood there, upon the little knoll above the flowing stream, framed in all its shiny whiteness against the greenness of the pines, and with a path leading from his old camping place up to where it sat.

He wielded the paddle savagely and drove the canoe to the shore. It grounded on the gravel and he stepped out and hauled it up the beach, where it would be safe from the tugging current.

Then he straightened and stared up at the house.

How would he tell Ben, he wondered. Or should he try to tell him? Might it not be better, when he talked with Ben, to disregard the house? You could not tell a man, lying in a hospital from which he had small chance of ever going home, that someone had robbed him of a segment of his past. For when a man is near the end, thought Gray, his past is somehow precious. And that, Gray admitted to himself, was the reason he himself resented the house upon the knoll.

Although, perhaps, he thought, he would not have resented it so much if it had not been so ridiculous. For it was not the kind of house for a place like this. If it had been a rustic structure, built of natural wood, with a great rock chimney, all built low against the ground, it would not have been so bad. For then it would have fitted, or would have tried to fit.

But this stark white structure, gleaming with the newness of its paint, was unforgivable. It was the sort of place that some junior executive might have built in some fashionable development, where all the other houses, sitting on the barren acres, would be of the same sleek architecture. There it would be quite all right and acceptable, but in this place of rock and pine it was an absurdity and an insult.

He bent stiffly and tugged the canoe farther up the beach. He lifted out his cased rod and laid it on the

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ground. He found the creel and strapped it on, and slung the pair of waders across his shoulders.

Then, picking up the rod, he made his way slowly up the path. For it was only dignified and proper that he make his presence known to these people on the knoll. It would not be right to go stalking past them, up the river, without an explanation. But he would be very sure not to say anything that might imply he was asking their permission. Rather it might be quite fitting, he told himself, to make very clear to them the prior right that he held and to inform them stiffly that this would be the last time he was coming and that he would bother them no further.

The way was steep. It had seemed of late, he thought, that all little slopes were steep. His breath was shorter now and his breathing shallow and his knees were stiff and his muscles ached from kneeling and paddling the canoe.

Maybe it had been foolish to try the trip alone. With Ben it would have been all right, for there would have been the two of them, the one to help the other. He had told no one that he planned the trip, for if he had they would have attempted to dissuade him—or what might have been far worse, offered to go along with him. They would have pointed out that no man of almost seventy should try such a trip alone. Although, actually, it was not much of a trip, at all. Just a few hours drive up from the city to the little town of Pineview and then four miles down the old logging road until he reached the river. And from there an hour of paddling up the river to the falls and the olden camping place just downstream from the falls.

Halfway up the slope he stopped to catch his breath and rest. From there he could see the falls, the white rush of the water and the little cloud of mist that, when the sun was right, held captive rainbows in it.

He stood looking at it all—the darkness of the pines, the barren face of rocky gorge, the flaming crimson and the goldenness of the hardwood trees, now turned into autumn bonfires by the touch of early frost.

How many times, he wondered—how many times had Ben and he fished above the falls? How many campfires had they lighted? How many times had they traveled up and down the river?

It had been a good life, a good way to spend their time together, two stody professors from a stodgy downstate college. But all things approach an end; nothing lasts forever. For Ben it had already ended. And after this one trip, it would be the end for him.

He stood and wondered once again, with a twinge of doubt, if he had made the right decision. The people at Wood's Rest seemed kind and competent and had shown him that he would be with the kind of people he could understand—retired teachers and ancient bankers and others from the genteel walks of life. But despite all this, the doubt kept creeping in.

It would have been so different, he thought, if only Clyde had lived. They had been closer than most sons and fathers. But now he had no one. Martha had been gone for many years and now Clyde was gone as well and there were no others.

On the face of it, from every practical consideration, Wood's Rest was the answer. He would be taken care of and he could live the kind of life, or at least an approximation of the kind of life, to which he was accustomed. It was all right now to keep on alone, but the time was coming when he would need someone. And Wood's Rest, while perhaps not the perfect answer, was at least an answer. A man must look ahead, he told himself, and that was why he had made the arrangements with Wood's Rest.

He was breathing easier now and he went on up the path until he reached the little patch of level ground that lay before the house.

The house was new, he saw, newer than he had thought at first. From where he stood he imagined that he could smell the newness of the paint.

And how, he wondered, had the materials which had been used to build it been gotten to the site? There was no sign of any road. It might, he thought, have been trucked down the ancient logging road and brought up the river from where he had left his car. But if that had been the case, the logging road would have shown the signs of recent travel, and it hadn't. It still was no more than a rutted track, its center overgrown with grass, that snaked its way through a tunnel of encroaching second growth. And if it had been brought by boat, there should have been a skidway or a road leading from the river to the site, and there was nothing but the faint, scarcely worn path up which he'd made his way. There would not have been time, he knew, for the wilderness and weather to have wiped out the traces, for he and Ben had been here fishing in the spring and at that time there had been no house.

Slowly he crossed the level place and the patio that looked out upon the river and the falls. He reached the door and pressed the button and far in the house he could hear the sound of ringing. He waited and no one came. He pressed the bell again. He heard the ringing from within the house and listened for the sound of footsteps coming to the door, but there were no footsteps. He raised his hand and knocked upon the door and at the knock the door came open and swung wide into the hall.

He stood abashed at this invasion of another's privacy. He debated for a moment whether he should reach in and close the door and quietly go away. But that, he told himself, had a sense of sneaking that he did not like.

"Hello!" he called. "Is anybody home?"

He would explain, when someone came, that he had merely knocked upon the door, that he had not opened it.

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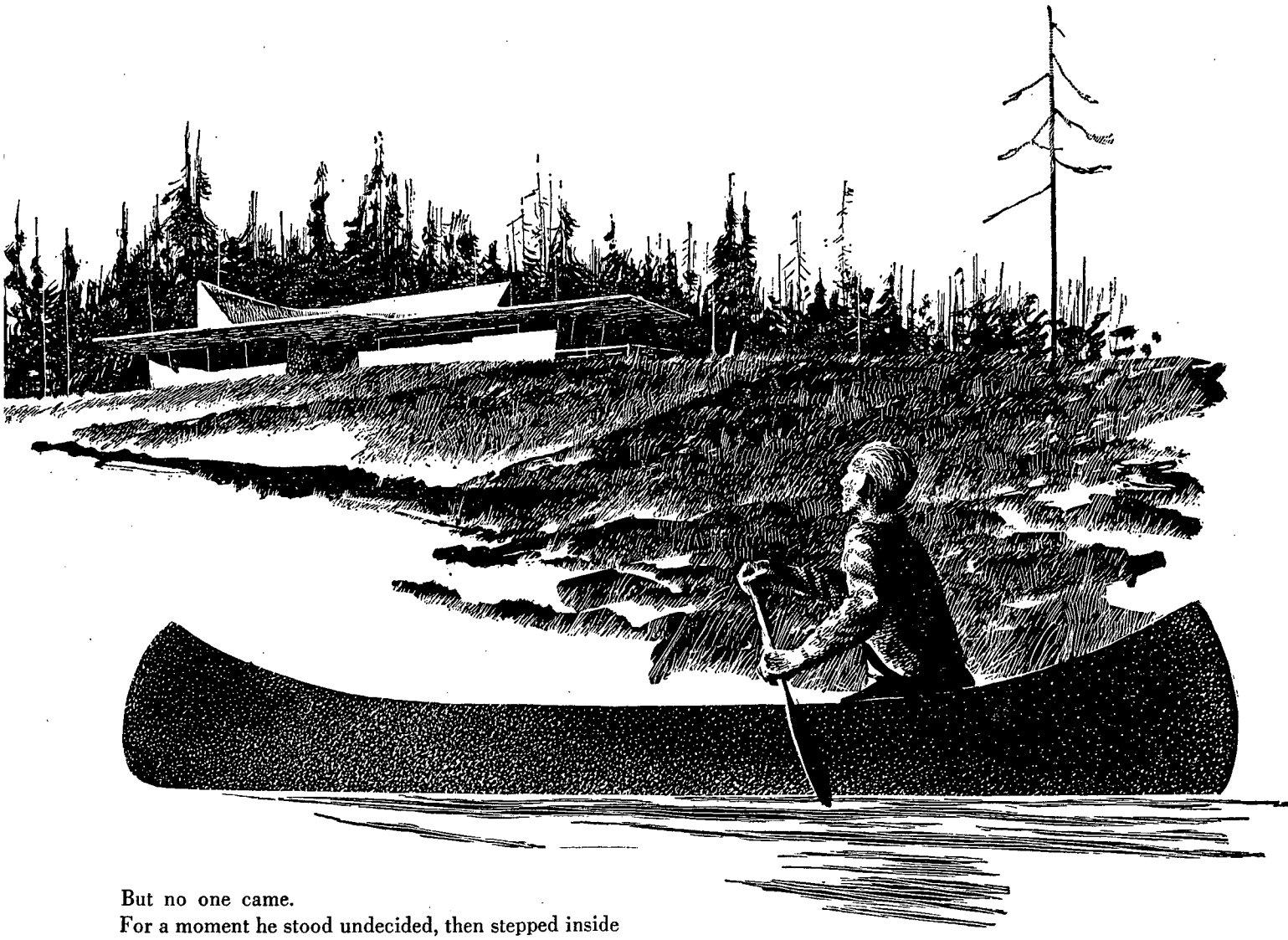

But no one came.

For a moment he stood undecided, then stepped inside the hall to grasp the doorknob and pull it shut.

In that instant he saw the living room, newly carpeted and filled with furniture. Someone was living here, he thought, but they were not at home. They had gone somewhere for a little while and had not locked the door. Although, come to think of it, no one up here ever locked a door. There was no need to lock them.

He would forget it, he promised himself, forget this house, this blot upon the land, and spend his day fishing and in the afternoon go back downriver to the car and home. He would not let his day be spoiled.

Sturdily, he set out, tramping long the ridge that took him above the falls and to that stretch of water that he knew so well.

The day was calm and clear. The sun was shining brightly, but there was still a touch of chill. However, it was only ten o'clock. By noon it would be warm.

He jogged along, quite happily, and by the time he donned the waders and stepped into the water, a mile above the falls, the house no longer mattered.

It was early in the afternoon that the accident occurred.

He had waded ashore and found a medium-sized boulder that would serve as a chair while he ate the lunch he'd brought. He had laid the rod down carefully on the shingle of the little beach and had admired the three trout of keeping size that rested in the creel. And had noted, as he unwrapped his sandwich, that the sky was clouding over.

Perhaps, he told himself, he should start home a bit sooner than he had planned. There was no point in waiting if there were a chance the weather would turn bad. He had put in three good hours upon the stream and should be satisfied.

He finished the sandwich and sat quietly on the boulder, staring at the smooth flow of the water against the rampart of the pines that grew on the farther bank. It was a scene, he told himself, that he should fix into his memory, to keep and hold forever. It would be something to think upon in the days to come when there were no fishing trips.

He decided that he'd take another half hour before he left the stream. He'd fish down to the point where the fallen tree lay halfway across the water. There should be trout in there, underneath the tree, hiding there and waiting.

He got up stiffly and picked up the rod and creel and

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stepped into the stream. His foot slipped on a mossy boulder hidden by the water and he was thrown forward. A sharp pain slashed through his ankle and he hit the shallow water and lay there for a moment before he could move to right himself.

His foot, the one that had slipped, was caught between two chunks of rock, wedged into a crevice in the stream bed. Caught and twisted and throbbing with a steady and persistent pain.

His teeth clenched against an outcry, he slowly worked the foot free and dragged himself back onto the shore.

He tried to stand and found that the twisted ankle would not bear his weight. It turned under him when he tried and a red-hot streak of pain went shooting through his leg.

He sat down and carefully worked off his waders. The ankle already was becoming swollen and had a red and angry look.

He sat upon the shingle of the beach and carefully considered all that he must do.

He could not walk, so he would have to crawl. He'd leave the waders and the rod and creel, for he could not be encumbered by them. Once he got to the canoe, he could make it down the river to where he'd parked his car. But when he got there, he'd have to leave the canoe behind as well, for he could never load it on top the car.

Once he was in the car, he would be all right, for he could manage driving. He tried to remember if there were a doctor at Pineview. It seemed to him there was, but he could not be sure. But, in any case, he could arrange for someone to come back and pick up the rod and the canoe. Foolish, maybe, he thought, but he could not give up the rod. If it wasn't picked up soon, the porcupines would find and ruin it. And he could not allow a thing like that to happen. For the rod was a part of him.

He laid the three—the waders, the creel and rod—in a pile beside the river where they could be spotted easily by anyone who might be willing to come back for them. He looked for the last time at the river and began the crawl.

It was a slow and painful business. Try as he might, he could not protect the ankle from bumps along the way and every bump sent waves of pain surging through his body.

He considered fashioning a crutch, but gave it up as a bad idea when he realized that the only tool he had was a pocket knife, and not too sharp a one.

Slowly he inched his way along, making frequent stops to rest. He could see, when he examined it, that the ankle was more swollen than before and the redness of it was beginning to turn purple.

And suddenly the frightening realization came, somewhat belatedly, that he was on his own. No one knew that he was here, for he had told no one. It would be days, if he failed to make it, before anyone would think to hunt for him.

It was a foolish thought. For he could make it easily. The hardest part came first and that was for the best. Once he reached the beached canoe, he would have it made.

If only he could keep crawling longer. If he didn't have to rest so often. There had been a day when he could have made it without a single rest. But a man got old and weak, he thought. Weaker than he knew.

It was during one of his rests that he heard the rising wind whining in the treetops. It had a lonesome sound and was a little frightening. The sky, he saw, was entirely clouded over and a sort of ghostly twilight had settled on the land.

He tried to crawl the faster, spurred on by a vague uneasiness. But he only tired the quicker and banged the injured ankle cruelly. He settled down again to a slower pace.

He had passed the fall line and had the advantage of a slightly downhill slope when the first drop of rain spattered on his outstretched hand.

And a moment after that the rain came in gusty sweeps of ice savagery.

He was soaked in the first few minutes and the wind was cold. The twilight deepened and the pines moaned in the rising gale and little rivulets of water ran along the ground.

Doggedly, he kept at his crawling. His teeth tried to chatter as the chill seeped in, but he kept his mouth clamped shut to stop the chattering.

He was better than halfway back to the canoe, but now the way seemed long. He was chilled to the bone and as the rain still came down it seemed to bear with it a great load of weariness.

The house, he thought. I can find shelter at the house. They will let me in.

Not daring to admit that his earlier objective, to reach the canoe and float down the river to where he'd left his car, had now become impossible and unthinkable.

Ahead, through the murkiness of the storm, he saw the glow of light. That would be the house, he thought. They—whoever they might be—were now at home and had turned on the lights.

It took longer than he had thought it would, but he reached the house with what seemed to be the last shred of his strength. He crawled across the patio and managed to pull himself erect beside the door, leaning on the house, bracing on one leg. He thumbed the button and heard the ringing of the bell inside and waited for the footsteps.

There weren't any footsteps.

And it wasn't right, he told himself. There were lights within the house and there should be people there. And if that were the case, why should he get no answer?

Behind him the moaning in the pines seemed deeper and more fearsome and there was no doubt that it had grown darker. The rain still came hissing down in its chilling fury.

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He balled his fist and pounded on the door and as it had that morning, the door swung open, to let the light spill out across the patio.

"Hello, in there!" he shouted. "Is anybody home?"

There was no answer and no stir, no sign of anything at all.

Hopping painfully, he crossed the threshold and stood within the hall. He called again and yet again and there was no response.

His leg gave out and he slumped upon the floor, catching himself and breaking the fall with his outstretched hands. Slowly, he inched his way along, crawling toward the living room.

He turned at the faint noise which came from behind his back and he saw that the door was closing—closing of its own accord and with no hand upon it. He watched in fascination as it closed, firm against the casing. The snick of the lock as it settled was loud in the stillness of the house.

Queer, he thought, fuzzily. Queer how the door came open as if to invite one in. And then when one was in, calmly closed itself.

But it did not matter what the door might do, he thought. The important thing was that he was inside and that the cold ferocity of the storm was shut in the outer dark. Already the warmth of the house was enfolding him and some of the chill was gone.

Careful not to bump the dragging ankle, he snaked himself along the carpeting until he reached a chair. He hauled himself upward and around and sat down in it, settling back into the cushions, with the twisted ankle thrust out in front of him.

Now, finally, he was safe. Now the cold and rain could no longer reach him, and in time someone would show up who could help him with the ankle.

He wondered where they were, these people to whom the house belonged. It was unlikely that they would stray far from it in a storm like this. And they must have been here not too long ago, because the lights were lit against the darkness of the storm.

He sat quietly, now only faintly aware of the dull throb of pain that was pulsing in the ankle. The house was warm and quiet and restful and he was glad for it.

Carefully he looked around, taking inventory.

There was a table in the dining room and it was set for dinner, with the steaming silver coffee pot and the gleaming china tureen and a covered platter. He could smell the coffee and there was food as well, of that he felt quite sure. But there was only one place set, as if one person only had been meant to dine.

A door opened into another room that seemed to be a study. There was a painting on the wall and a massive desk set beneath the painting. There were floor to ceiling bookcases, but there were no books in them.

And a second door led into a bedroom. There was a bed turned down and a pair of pajamas were folded on the pillow. The lamp on the bedside table had been lit. As if the bed were waiting for someone to sleep in it, all turned down and ready.

But there was a strangeness, a fantastic something about the house that he could not quite put his finger on. Like a case at law, he thought, where there was a certain quality that eluded one, always with the feeling that this certain quality might be the very key to the case itself.

He sat and thought about it, and suddenly he knew.

The house was furnished, but the house was waiting. One could sense a feeling of expectancy, as if this were a house that was waiting for a tenant. It was set and ready, it was equipped and furnished. But there was no one living here. It had an unlived-in smell to it and a vague sort of emptiness.

But there was foolishness, he told himself. Of course, there was someone living in it. Someone had turned on the lights, someone had cooked a dinner and set a place for one, someone had lit the bedside lamp and turned down the covers of the bed.

And yet, for all the evidence, he couldn't quite believe it. The house still persisted in its empty feeling.

He saw the trail of water he'd left in his crawl along the hall and across the carpeting to reach the chair. He saw the muddy handprints he'd left upon the wall where he had braced himself when he'd hobbled in.

It was no way to mess up a place, he thought. He'd do his best to explain it to the owner.

He sat and waited for the owner, nodding in the chair.

Seventy, he thought, or almost seventy, and this his last adventure. All his family gone and all his friends as well—all except old Ben, who was dying slowly and ungracefully in the alien and ungraceful atmosphere of a small hospital room.

He recalled that day of long ago when Ben and he had met, two young professors, Ben in astronomy and himself in law. They had been friends from the very first and it would be hard to have Ben go.

But perhaps he would not notice it, he thought, as much as he might have at one time. For he, himself, in another month, would be settled down at Wood's Rest. An old folks' home, he thought. Although now they didn't call them that. They called them fancy names like Wood's Rest, thinking that might take the sting away.

It didn't matter, though. There was no one left to whom it might matter now—except himself, of course. And he didn't care. Not very much, that is.

He snapped himself erect and looked at the mantle clock.

He'd dozed away, he thought, or been dreaming of the old days while no more than half awake. Almost an hour had passed since he'd last glanced at the clock and still the house was empty of anyone but he.

The dinner still was upon the table, but it would be cold by now. Perhaps, he thought, the coffee still might be a little warm.

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He pushed forward in the chair and rose carefully to his feet. And the ankle screamed at him. He fell back into the chair and weak tears of pain ran out of his eyes and dribbled down his cheeks.

Not the coffee, he thought. I don't want the coffee. If I can just make it to the bed.

He pulled himself tenderly from the chair and crawled into the bedroom. By slow and painful maneuver, he stripped off his sodden clothing and got into the pajamas that had been folded on the pillow.

There was a bathroom off the bedroom and by hopping from bed to chair to dresser he finally reached it.

Something to kill the pain, he told himself. Aspirin would be of some little help if he could only find one.

There was a medicine cabinet above the basin and he jerked it open, but the shelves were empty.

After a time he made it back to the bed again and crawled beneath the covers, switching off the bedside light.

Lying stiff and straight, shivering with the effort of getting into bed, he wondered dully what would happen when the owner should return and find a stranger in the bed.

But he didn't care. He was beyond all caring. His head was large and fuzzy and he guessed he had a fever.

He lay quietly, waiting for sleep to come to him, his body fitting itself by slow degrees into the strangeness of the bed.

He did not even notice when the lights throughout the house went out.

He awoke to the morning sun, streaming through the windows. There was the odor of frying bacon and of brewing coffee. And a telephone was ringing, loudly and insistently.

He threw off the covers and was halfway out of bed to answer the telephone when he remembered that this was not his house, that this was not his bed, that the ringing phone could not possibly be for him.

He sat upon the edge of the bed, bewildered, as the memory of the day before came crashing in upon him.

Good Lord, he thought, a phone! There can't be a phone. Way out here, there can't.

But still it kept on ringing.

In just a little while, he thought, someone would come to answer it. The someone who was frying bacon would come and answer it. And when they did, they'd go past the open door and he would be able to see them and know to whom the house belonged.

He got out of bed. The floor beneath his feet was cold and there might be slippers somewhere, but he didn't know where to look for them.

He was out in the living room before he remembered that he had a twisted ankle.

Stopping in amazement, he looked down at it and it looked as it had always looked, no longer red or purple, and no longer swollen. And most important, not hurting any more. He could walk on it as if nothing had ever been the matter with it.

The phone standing on the table in the hall pealed aloud at him.

"I'll be damned," said Frederick Gray, staring at his ankle.

The phone brayed at him again.

He hurried to the table and snatched the handpiece off the cradle.

"Hello," he said.

"Dr. Frederick Gray, perhaps."

"You are right. I am Frederick Gray."

"I trust you had a restful night."

"A very restful one. And thank you very much."

"Your clothes were wet and beyond repair. We disposed of them. I hope that you don't mind. The contents of the pockets are on the dressing table. There is other clothing in the closet that I am sure will fit you."

"Why," said Frederick Gray, "that was very thoughtful of you. But would you mind telling me—"

"Not at all," the caller said, "but perhaps you'd better hurry out and get your breakfast. It will be getting cold."

The phone went dead.

"Just a minute," Gray yelled at it. "Just hold on a minute—"

But the buzz of an empty line kept sounding in his ear.

He hung up and went into the bedroom, where he found a pair of slippers tucked beneath the bed.

We hope you had a restful night Your clothes were wet, so we disposed of them. We put the contents of the pockets on the dressing table.

And who in the world were we?

Where was everyone?

And what happened, when he slept, to repair the ankle?

He had been right the night before, he thought. It was an empty house There was no one here. But in some manner which he could not fathom, it still was tenanted.

He washed his hands and face, but did not bother with a shave, although when he looked into the medicine cabinet, it was no longer empty. It now held shaving tackle, a toothbrush and a tube of paste, a hairbrush and a comb.

Breakfast was on the table in the dining room and there was only one place set. There were bacon and eggs, hash brown potatoes, tomato juice, toast and a pot of coffee.

But there was no sign of anyone who might have prepared the food or placed it on the table.

Could there be, he wondered, a staff of invisible servants in the house who took care of guests?

And the electricity, he wondered. Was there a private power plant? Perhaps one that was powered by the waterfall? And what about the phone? Could it be a radio-

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phone? He wondered if a radiophone would look different from just an ordinary phone. He could not recall that he had ever seen one.

And who had been the caller?

He stood and looked at the waiting breakfast.

"Whoever you are," he said, aloud, "I thank you. I wish that I could see you. That you would speak to me."

No one spoke to him.

He sat down and ate the breakfast, not realizing until he put the food into his mouth how hungry he had been.

After breakfast he went into the bedroom and found the clothes hanging in the closet. Not fancy clothes, but the kind of outfit a fisherman would wear.

Coming out of the bedroom, he saw that the breakfast things had been cleared off the table.

He stepped outside into the sunshine and the day was beautiful. The storm had blown itself out sometime in the night.

Now that he was all right, he told himself, perhaps he'd better go upstream and bring down the rod and the other stuff he'd left. The rest of it didn't amount to much, but the rod was much too good to leave.

It all was there, piled where he had left it, neatly on the shore. He bent down and picked up the rod and stood facing the river, with it in his hand.

Why not? he asked himself. There was no hurry to get back. As long as he was here he might as well get in a bit of fishing. He'd not have another chance. He'd not come back again.

He laid the rod aside and sat down to pull on the waders. He emptied the fish he'd caught the day before out of the creel and strapped it on his shoulder.

And why just this morning? he asked himself. Why just another day? There was no reason to get back and he had a house to stay in. There was no reason he shouldn't stay a while and make a real vacation of it.

He stood aghast at how easily he accepted the situation, how ready he found himself to take advantage of it. The house was a thing of mystery, and yet not terrifying. There was nothing in the house, strange as it might be, that a man need be afraid of.

He picked up the rod and stepped into the stream and whipped out the line. On the fifth cast a trout struck. The day had started fine.

He fished to the first break of the rapids just above the falls, then clambered out on shore. He had five fish in the creel and two of them were large.

He could fish the rapids from the shore, he thought, but perhaps he shouldn't. He should be getting back for a good look at the house. He had to settle in his mind the truth about the power source and the telephone and there might be a lot of other things that needed looking into.

He glanced down at his watch and it was later than he thought. He untied the fly and reeled in the line and disjointed the rod, then set off down the trail.

By the middle of the afternoon, he had finished his inspection of the house.

There were no power and no telephone lines coming to the house and there was no private power plant. The house was conventionally wired for electricity, but there was no source that he could find. The telephone plugged into a jack in the hall and there were other jacks in the bedroom and the study.

But there was another item: The night before, as he sat in the living room, he could see into the study. He had seen the painting and the desk and the empty book shelves. But now the shelves were no longer empty. They fairly bulged with books and the kind of books that he would have chosen if he had put them there himself—a law library that would have been the envy of any practicing attorney, and with a special section that he first took to be a joke.

But when he looked at the phone directory, it had seemed somewhat less a joke.

For it was no such directory as any man had ever seen before. It listed names and numbers, but the addresses ranged the galaxy!

Besur, Yar, Mekbuda V—FE 6-8731

Beten, Varmo, Polaris III—GR 7-3214

Beto, Elm, Rasalgethi IX—ST 1-9186

Star names, he thought, and the planet numbers. They could be nothing else.

And if it were a joke, it was pointless and expensive.

Star names listed in the pages of the directory and those other star names upon the books in that special section in the study!

The obvious conclusion, he told himself, rather plaintively, was too outrageous to be given even slight consideration. It was outrageous and ridiculous and it made no sense and he would not entertain it. There must be other answers and the one he did not like to think about was that he'd gone insane.

There might be a way, he thought, that it could be settled.

He flipped the directory closed and then opened the front cover and there it was: TELEPHONE SERVICE CALLS. He lifted the receiver and dialed for INFORMATION.

There were two ringing sounds and then a voice said:

"Good evening, Dr. Gray. We are glad you called. We hope everything's all right. There isn't any trouble?"

"You know my name," said Gray. "How do you know my name?"

"Sir," said Information, "it is a point of pride with us that we know the name of each of our subscribers."

"But I'm not a subscriber. I'm only—"

"Oh, but you are," insisted Information. "As soon as you took possession of the house—"

"Possession! I did not—"

"But, Dr. Gray, we thought you knew. We should have told you at the start. We are very sorry. The house, you see, is yours."

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"No," Gray said, weakly, "I did not understand."

"Yours," said Information, "so long as you may need it, so long as you may want to keep it. The house and everything that's in it. Plus all the services, naturally, that you may require."

"But it can't be mine," said Gray. "I have done nothing that would make it mine. How can I own a house for which I've given nothing?"

"There might be," said Information, "certain services that, from time to time, you might be willing to perform. Nothing strenuous, of course, and not required, you understand. If you would be willing to perform them, we would be the ones who would stand in debt. But the house is yours no matter what you may elect to do."

"Services?" asked Gray. "There are few services, I am afraid, that I could perform."

"It does not really matter," Information told him. "We are very glad you called. Call us again any time you wish."

The connection clicked and he was left, standing foolishly with the receiver in his hand.

He put it back into the cradle and went to the living room, sitting in the chair he'd sat in when he'd found his way into the house the night before.

While he'd been busy in the hall with the telephone, someone—or something, or some strange procedure—had laid wood in the fireplace and had lit it and the brass wood carrier that stood beside the hearth was filled with other wood against the need of it.

He watched the fire creeping up the logs, flickering as it climbed, with the cold wind outside growling in the chimney.

An Old Folks' Home, he thought.

For if he'd heard aright, that was what it was.

And a better one, by far, than the one he had planned to enter.

There was no reason in the world why anyone should give this house to him. He had done nothing he could think of that entitled him to have it.

An Old Folks' Home, all to himself, and on his favorite trout stream.

It would be wonderful, he thought, if he only could accept it.

He hitched the chair around so he could face the fire. He had always liked a fire.

Such a pleasant place, he thought, and such thoughtful service. He wished that he could stay.

And what was there to stop him? No one would mind if he did not return. In a day or two he could make his way out to Pineview and mail a couple of letters that would fix it so no one would hunt for him.

But it was madness, he thought. What if he got sick? What if he fell and hurt himself? He could not reach a doctor and there would be no one to help him.

Then he thought of how he'd hunted for an aspirin and there had been no aspirin. And how he'd crawled into bed with a twisted, swollen ankle that had been all right when he got up in the morning.

He had no worry, he realized, about ever being sick.

There had been no aspirin tablet because there had been no need of any.

This house was not a house alone. It was more than just a house. It was a shelter and a servant and a doctor. It was a safe and antiseptic house and it was compassionate.

It gave you everything you wanted. It fulfilled your every need. It gave you fire and food and comfort and a sense of being cared for.

There were the books, he thought. The rows and stacks of books, the very kind of books by which he'd lived for years.

Dr. Frederick Gray, dean of the school of law. Filled with honor and importance until he got too old, until his wife and son had died and all his friends were gone or incapacitated. Now no longer dean, now no longer scholar, but an old man with a name that was buried in the past.

He rose slowly from the chair and went into the study. He put out his hand and rubbed the palm of it along the leathery spines of a row of books.

These were the friends, he told himself, the friends a man could count on. They always were in place and waiting for the time a man might need them.

He stopped in front of the section that had puzzled him at first, which he had thought of as a farfetched joke. But now he knew there was no joke.

He read the titles of a few of them: "Basic Statutes of Arcturus XXIV," "Comparison of the Legal Concepts of the Centaurian Systems," "Jurisprudence on Zubeneschamali III, VI and VII," "The Practical Law of Canopus XII." And many others with the strange names in their titles.

Perhaps, he thought, he would not have recognized the names so readily had it not been for Ben. For years he had listened to him talk about his work, reeling off many of these very names as if they might be places no farther off than just down the street a ways.

And maybe, thought Frederick Gray, they were not so far, at that. All he had to do to talk to men—no, not men, perhaps, but beings—in all of these strange places was to walk out in the hall and dial their numbers on the phone.

A telephone directory, he thought, with numbers for the stars, and on all these shelves law books from the stars.

Perhaps there were, on those other solar systems, nothing like a telephone or a telephone directory; perhaps, on those other planets there weren't any law books. But here on Earth, he told himself, the means of communication had to be a telephone, the means of information books upon the shelf. For all of it had to be a matter of translation, twisting the unfamiliar into something that was familiar and that one could use.

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And translation not for Earth alone, but for all those other beings on all those other planets. On each of a dozen planets there might be a different means of communication, but in the case of a call to him from any of those planets, no matter what means the creature of the planet might employ, the telephone would ring.

And the names of those other stars would be translations, too. For the creatures who lived upon the planets circling Polaris would not call their sun Polaris. But here on Earth it had to be Polaris, for that was the only way a human had to identify the star.

The language would have to be translated, too. The creatures he had talked with on the phone could not have spoken English, and yet it had been English when it had reached his ear. And his replies, he knew, must have reached that other party in some language other than the tongue that he had used.

He stood aghast at the very thought of it, wondering how he could abide such an explanation. And yet there was no choice. It was the only explanation that would fit the situation.

Somewhere a bell rang sharply and he turned from the shelves of books.

He waited for it to ring again, but it did not ring.

He walked into the living room and saw that dinner had been set upon the table and was waiting for him.

So that was what it had been, he thought. A bell to summon him to dinner.

After dinner, he went back to the living room to sit before the fire and fight the whole thing out. He assembled the facts and evidence in his old lawyer's mind and gave full consideration to all possibilities.

He touched the edge of wonder and shoved it to one side, he erased it carefully—for in his consideration of this house there was no room for wonder and no place for magic.

Was it no more than illusion? That was the first question one must ask. Was this really happening, or was he

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just imagining that it was happening? Was he, perhaps, in all reality, sitting underneath a tree or squatting on the river bank, mumbling at nothing, scratching symbols in the dirt with his fingernails, and living the fantasy of this house, this fire, this room?

It was hard to believe that this might be the case. For there were too many details. Imagination formed a hazy framework and let it go at that.

There were here too many details and there was no haziness and he could move and think of his own volition; he still was the master of himself.

And if it were not imagination, if he could rule out insanity, then this house and all that happened must be, indeed, the truth. And if it were the truth, then here was a house built or shaped or somehow put into being by some outside agency that was as yet unsuspected in the mind of humankind.

But, he asked himself, why would they want to do it? What could be the motive?

With a view, perhaps, of studying him as a representative specimen of the creature, Man? Or with the idea that somehow they could make some use of him?

The thought struck him—was he the only man? Might there be others like him? Men who kept very silent about what was happening, for fear that human interference might spoil this good thing that they had?

He rose slowly from the chair and went out in the hall. He picked up the phone directory and brought it back with him. He threw another log upon the fire and sat down in the chair, with the phone book in his lap.

First himself, he thought; he would see if he was listed.

He had no trouble finding it: Gray, Frederick, Helois III—SU 6-2649.

He flipped the pages and started from the front, running his finger slowly down the column.

The book was thin, but it took him quite a while, going carefully so that he would not miss another man from Earth. But there was no other listed; not from Earth, not from the solar system. He was the only one.

Loneliness, he wondered. Or should it be just a touch of pride. To be the only one in the entire solar system.

He took the directory back to the table in the hall and lying in the place where he had gotten it was another one.

He stared at it and wondered if there were two of them, if there had been two of them all along and he had never noticed.

He bent to look the closer at it and when he did he saw that it was not another directory, but a file of some sort, with his name printed across the top of it.

He laid the directory down and took up the file. It was a bulky and a heavy thing, with great sheaves of papers enclosed between the covers.

It had not been there, he was certain, when he'd gotten the directory. It had been placed there, as the food was placed upon the table, as the books had been stacked upon the shelves, as the clothing that would fit him had been hung within the closet. By some agency that was unobtrusive, if not invisible.

Placement by remote control, he wondered. Could it be that somewhere this house was duplicated and that in that house certain agencies that were quite visible—and in their term of reference logical and ordinary—might place the food and hang the clothes and that at the moment of the action the same things happened in this house?

And if that were the case, not only space was mastered, but time as well. For they—whoever they might be—could not have known about the books that should be placed upon the shelves until the occupant of this house had appeared upon the scene. They could not have known that it would be Frederick Gray, that it would be a man who had made the law his business, who would blunder on this house. They had set a trap—a trap?—and there would have been no way for them to know what quarry they might catch.

It had taken time to print, by whatever process, the books upon the shelves. There would have been a searching for the proper books, and the translating and the editing. Was it possible, he wondered, that time could be so regulated that the finding and the translating and the editing, the printing and the placement, could have been compressed into no more than twenty-four hours as measured on the Earth? Could time be stretched out and, perhaps, foreshortened to accommodate the plans of those engineers who had built this house?

He flipped open the cover of the file and the printing on the first page struck him in the face.

SUMMARY & TRANSCRIPT
Valmatan vs. Mer El
Referral for Review
Under Universal Law

Panel for Review:

Vanz Kamis, Rasalgethi VI
Eta Nonskic, Thuban XXVIII
Frederick Gray, Helios III

Frozen, he stared at it.

His hands began to tremble and he laid it down, carefully on the table top, as if it might be something that would shatter if he dropped it.

Under universal law, he thought. Three students of the law, three experts(?), from three different solar systems!

And the facts at issue, and the law, more than likely, from yet another system.

Certain little services, the voice on the phone had told him.

Certain little services. To pass judgment under laws and jurisprudence he had never heard of!

And those others, he wondered—had they heard of them?

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Swiftly he bent and leafed through the phone book. He found Kamis, Vanz. Deliberately, he dialed the number.

A pleasant voice said: "Vanz Kamis is not present at the moment. Is there any message?"

And it was not right, thought Gray. He should not have phoned. There was no point in it.

"Hello," said the pleasant voice. "Are you there?"

"Yes, I am here," said Gray.

"Vanz Kamis is not at home. Is there any message?"

"No," said Gray. "No, thanks. There isn't any message."

He should not have called, he thought. The act of phoning had been an act of weakness. This was a time when a man must rely upon himself. And he had to give an answer. It was not something that could be brushed off, it was not a thing that anyone could run from.

He got his cap and jacket from the closet in the hall and let himself outside.

A golden moon has risen, the lower half of it bearing on its face the dark silhouette of the jagged pines, growing on the ridge across the river. From somewhere in the forest an owl was muttering and down in the river a fish splashed as it jumped.

Here a man could think, Gray told himself. He stood and drew the freshness of the air deep into his lungs. Here on the earth that was his own. Better than in a house that was, at least by implication, the extension of many other worlds.

He went down the path to the landing where he had beached the canoe. The canoe was there and there was water in it from the storm of the night before. He tipped it on its edge so the water could run out.

To be reviewed, that first page had said, under universal law. And was there, he wondered, such a thing as universal law?

Law could be approached in many ways, he thought. As pure philosophy, as political theory, as a history of moral ideas, as a social system, or as a set of rules. But however it was viewed, however studied, no matter what the emphasis, it had one basic function, the providing of a framework that would solve all social conflict.

Law was no static thing; it must, and did, evolve. No matter how laggard it might be, still it followed in the footsteps of the society it served.

He grinned wryly in the darkness, staring at the foaming river, remembering how, for years, he had hammered on that viewpoint in seminar and lecture.

On one planet, given time and patience and the slow process of evolution, the law could be made to square with all social concepts and with the ordered knowledge of society at large.

But was there any chance to broaden this flexibility and this logic to include not one, but many planets. Did there exist somewhere a basis for a legal concept that would apply to society in the universal sense?

It could be true, he thought. Given wisdom and work, there was a bare chance of it.

And if this should be the case, then he might be of service, or more correctly, perhaps, the law of Earth might be of help. For Earth need not be ashamed of what it had to offer. The mind of Man had lent itself to law. For more than five thousand years there was a record of Man's concern with law and from that deep concern had come a legal evolution—or, more correctly, many evolutions. And in it might be found a point or two that could be incorporated in a universal code.

There was, throughout the universe, a common chemistry, and because of this there were those who thought that there was a common biochemistry as well.

Those other beings on those two other planets who had been named with him to review the issue set forth in the transcript could not be expected to be men, or even close to men. But given a common biochemistry, they would be basically the same sort of life as Man. They would be protoplasmic. They would make use of oxygen. The kind of things they were would be determined by nucleic acids. And their minds, while more than likely a far cry from a human mind, still would be based upon the same mechanism as the minds of Man.

If there were, he asked himself, a common chemistry and a common biochemistry, then did it not seem likely, as well, for there to exist a concept that would point toward common justice?

Not just yet, perhaps. But ten thousand years from now. Or a million years from now.

He started up the path again and his step was lighter than it had been for years, and the future brighter—not his future only, but the future of everything that was.

This was a thing he'd taught and preached for years—the hope that in some future time the law might represent some great and final truth.

It did a man's heart good, he thought, to find that there were others who felt the same as he, and who were at work on it.

No Old Folks' Home, he thought, and he was glad of that. For an Old Folks' Home was a dead end, and this was a bright beginning.

In a little while the phone would ring and there'd be a voice asking if he'd serve.

But he'd not wait for that. There was work to do—a great deal of work to do. There was the file to read and those strange books that he must study, and references that he would have to find and much thinking to be done.

He entered the house and shut the door behind him. He hung up his cap and coat.

Picking up the file, he went into the study and laid it on the desk.

He pulled out a drawer and took out pad and pencils and ranged them neatly, close at hand.

He sat down and entered upon the practice of interstellar law. ■

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THE BIG FUEL FEUD

Continued from page 16

allocating the lion's share of development funds to liquids are based on their potentialities, most of which are yet to be proven in actual rocket firings. The "exotic" propellants, which give the liquid-propellant people such high hopes, are bi-propellant combinations in which fluorine is the oxidizing agent. Liquid fluorine is used in some of them: others use a compound from which fluorine is liberated in the combustion chamber.

In view of its supposed importance to the future of liquid propellants, it would be fitting and proper that we step back and take another look at liquid fluorine, and also give it another think.

Let's assume that we have overcome all of the little difficulties having to do with the development of materials and designs for the storing, handling, pumping, metering, valving, et cetera, of this most corrosive of all substances. Then let us assume, further, that we have just launched an interplanetary rocket which burns liquid fluorine and (Oops! Sorry—the nature of the fuel component is classified!) as the propellant.

Amid a roaring avalanche of sound and a cascade of lethal gases, our rocket climbs, slowly at first, then faster and faster into the cloudless cerulean of the typical Florida sky.

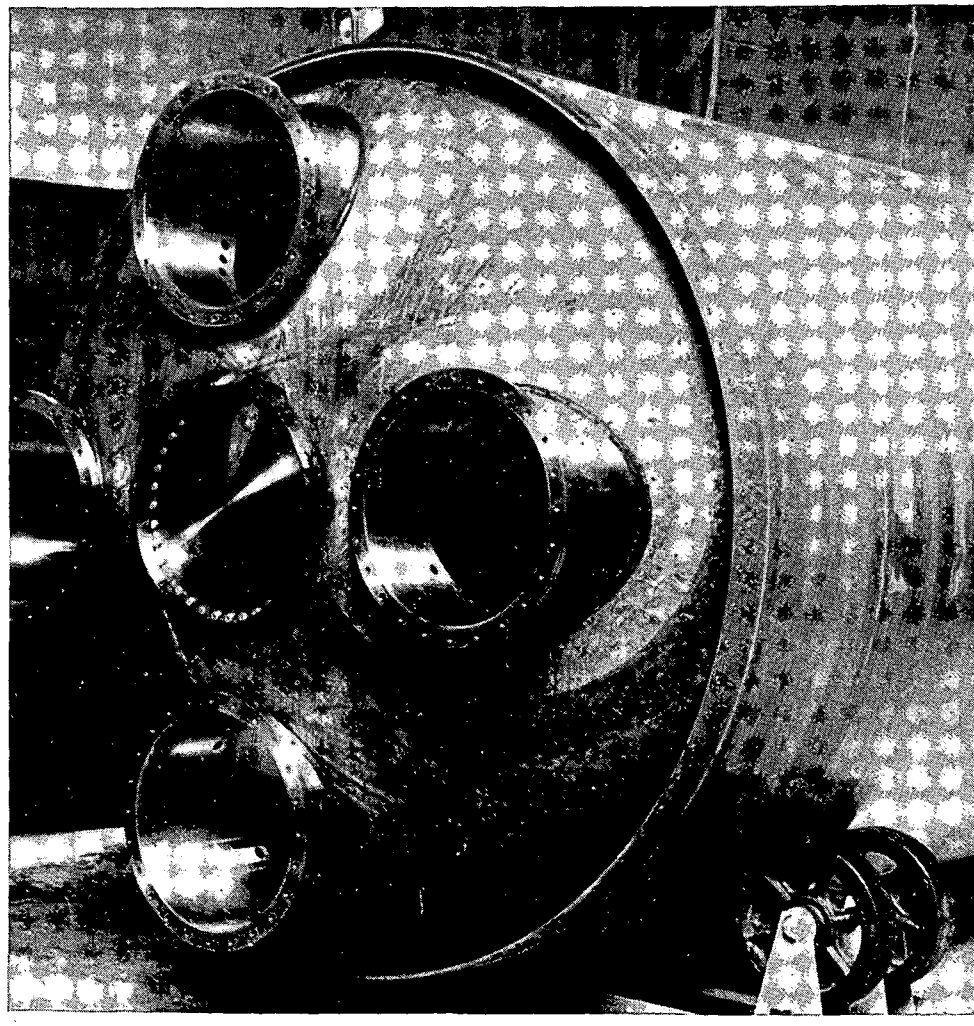
Then someone happens to notice a flashing red light on the telemetering panel, which means that the hyperdeclavitator has sprung a geodesic. Any amateur knows, of course, that this dreaded malfunction can only result in a subterranean perigee, so the Range Officer shifts his ham-and-cheese sandwich to his left hand, moves his cup of coffee to one side out of the way, and pushes a well-worn big red button.

So far, everything has been routine—but now what happens? Well, there is the heart-rending spectacle of a multi-megabuck rocket disintegrating into a cloud of smoke and small, irregularly shaped fragments of assorted hardware. In this particular instance, however, there is more! Remember, that aboard this rocket was a large quanity of liquid fluorine. The exact amount would depend upon the size of the rocket, but it undoubtedly would be measured in tons. And, unless the rocket was at a very great altitude at the time of its destruction, a lot of that fluorine will reach the water—or the ground, Heaven forbid!—as a liquid.

Fluorine is so active that it will take the hydrogen right out of an H_2O molecule and combine with it to form hydrogen fluoride, releasing large quantities of heat in the process. In other words, fluorine will *burn water!* So, when the liquid fluorine reaches the water, it will set the ocean afire—actually, not figuratively—where it hits, and for quite a distance around! Hydrogen fluoride (hydrofluoric acid) will, of course, go into solution in the sea water. You will probably remember that weak solutions of hydrofluoric acid are used for etching glass. Imagine, then, what our sea-water solution would do to one of Florida's beautiful silica-sand beaches.

Naturally, a considerable amount of the fluorine would vaporize as it fell through the air. Bearing in mind that fluorine gas is many times as

Fig. 13: Nozzle end of the motor case shown in Fig. 11 and Fig. 12 after completion. The skirt—extension of cylindrical section of the case—was wound separately and cemented in place. Glass-filament-wound motor cases are stronger, weight-for-weight, than steel cases.
Courtesy: Lamtex Industries, Inc.



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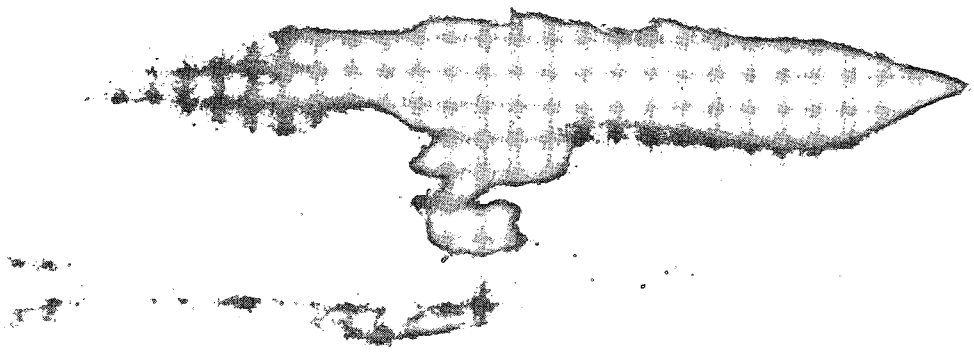

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toxic as the chlorine gas used by the Germans in World War I, it is easy to see how, if there happened to be a breeze blowing inland, the local population pressure would be relieved quite rapidly.

Please don't misunderstand me. I would like to watch them launch a fluorine rocket at Cape Canaveral—by television, from Vandenberg. This, I'll admit, is somewhat of an exaggeration. If I were certain that a stiff breeze would be blowing south from the Cape for three days after launching, I might consent to being as close as, say, Huntington, West Virginia!

There are techniques for decontaminating a fluorine "spill," but none, to my knowledge, that would be effective in a case such as we have been considering.

One of the fluorine compounds under development for use in liquid propellants, oxygen bifluoride (OF_2), is interesting in its own right. It has the lowest melting point of any known compound (—371°F.), and is out-ranked in oxidizing power only by fluorine and atomic oxygen. Its boiling point and critical temperature are —229°F. and —72°F., respectively, which places it in the cryogenic category. It is just as toxic and about as corrosive as fluorine, but is said to be safer to handle and easier to store. Its two main theoretical advantages seem to be its high bulk density and the fact that it contains both fluorine and oxygen—which enables it to react efficiently with either carbonaceous or noncarbonaceous fuels. One of its practical disadvantages is that it is even more expensive than fluorine.

Fig. 14: High-altitude exhaust trail of a Thor IRBM launched from Vandenberg Air Force Base just after sunset. The exaust gases, illuminated by the upward-slanting rays of the sun, stand out sharply against the dark sky. At lower levels, the trail is broken up by shearing winds. The enormous expansion at upper levels illustrates how rocket exhaust gases released at the "edge of space" could contaminate the upper atmosphere over large areas of the earth. The picture was taken from the author's front yard at China Lake, California, in the Mojave Desert approximately 175 miles from the launching site.

Photo by Harry B. Porter, Jr.

There are many fluorine compounds being developed or being considered for development: nitrogen trifluoride (NF_3), chlorine trifluoride (ClF_3), and perchloryl fluoride (ClO_3F), to name three. But, in view of the fact that the fluorine-hydrogen combination gives less than five per cent higher specific impulse than oxygen-hydrogen, and keeping in mind that elemental fluorine is the best of the "exotic" oxidizers—one wonders. LOX is still relatively inexpensive and easy to handle.

While we are discussing the chemical aspects of propellants, there is one more thing that perhaps we should ponder a little—something that applies equally to solids, liquids, and hybrids: the possible effects of propellant combustion products on the atmosphere.

Dr. Harry Wexler, Director of Meteorological Research, U. S. Weather Bureau, admits that the effects of releasing large quantities of chemicals from rocket exhausts are not known, and that some of the results may be strange. He speculates that chlorine in the exhausts might dissipate the ozone layer in the upper atmosphere. He is referring to the same ozone layer that absorbs most of the ultraviolet solar radiation that would otherwise destroy all land-dwelling life on the earth.

At first thought, it may seem ridiculous that such a relatively small amount of gas could have any measurable effect whatever on the atmosphere. At the altitude of the ozone layer, however, the air density is only about one per cent of what it is at sea level—and even a small amount of gas, under practically no pressure, can occupy a tremendous volume. When, in the perhaps not-too-distant future, regularly scheduled flights are blasting off daily for Tycho City or Marsville, upper-air pollution may be a big problem.

Sounds like a screwball idea? Well, so did the idea that a thermonuclear explosion a couple of hundred miles out in space might create another radiation belt. Wonder how long it will be before it will be safe for an astronaut to orbit at three hundred miles?

But to return to the original question as to whether liquid or solid propellants are superior. The question is, of course, semantically meaningless. Superior in what way, and under what conditions?

If we are talking bout "space" rockets or ICBM's, there is a definite advantage to getting through the denser, drag-producing regions of the atmosphere in a hurry. This requires a lot of initial thrust. Solid propellants can produce a tremendous amount of thrust for a relatively short time: liquid propellants can generate a somewhat smaller thrust for a long time. It would appear, then—all other things being equal—that it would be advantageous to use solid-propellant boosters, with liquid-propellant engines for the upper stages. But all other things are *not* equal, as I've tried to point out.

Perhaps you are wondering how I stand on the question. Well, if someone should ask me, "Do you think we should give the greater support to the development of solid- or liquid-propellant systems?" my answer would be an unhesitating and unequivocal "Yes!" ■

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BY JOSEPH GOODAVAGE

REPORT ON CRUCIAL EXPERIMENT NO. 5

FEBRUARY

ASTRO FORECAST

Increased intensity of arctic blasts stemming from the interior Midwest in eastward transit during the last week of January has probably *initiated* the approaching Deep Freeze.

Low pressure patterns with counterclockwise air flows in the northwest quadrant for February denotes superabundant snowfalls, even in the normally dry northwestern states.

Closely scattered, brief extremes will occur in higher elevations of the Far West.

Cold weather will harden over the central states and intensify over the eastern third of the U.S. and Canada. Abnormally high barometric readings—above 31 inches—will be reported in communities along the northern border from the upper lakes region anywhere eastward and into Northern New England.

Over higher elevations and inland the snow and ice will accumulate—and stick.

A greater pattern will be set by high pressure and low temperatures spawning from the Pacific N'west on February 4 & 5 while a major low souths over Calif. late on the 4th and spreads into the S'west on the 5th and & 6th to center over the S. Atlantic states around midnight of the 7th.

ACTUAL WEATHER

The week ending February 4, 1963 was the third consecutive unusually cold week, with averages as much as 18° below normal in the Midwest. Cold waves moved across the area early and late in the week, bringing subzero minima southward to the central Great Plains and the Ohio Valley.

Heavy precipitation caused widespread flooding in southern Idaho the latter part of the week. Severe local flooding was reported near Reno, Nev. Snowfall increased the snowpack in the Sierras and Cascades. 100-mph blizzards lashed the Rocky mountain area of Colorado.

Chinook winds, with temperatures up to 64° in Wyoming removed the snow from lower levels and caused snowslides in the mountains.

A cold wave moved across the northeast quarter of the nation on February 6th, reducing temperatures to subzero levels in most of New England, New York, Pennsylvania, and some other areas of adjoining states. Another cold wave moved into New England on the heels of a storm that dumped 8″ of fresh snow. Burlington, Vermont, recorded —20°.

Snow cover east of the Rockies was heaviest in Maine, over two feet covering northern and interior sections. Greenville, Maine, reported forty-six inches on the ground.

Precipitation was heavy along the Pacific coast, in sections of the lower Rockies, an area including portions of eastern Arkansas and western Tennessee, and in parts of Florida and the South Atlantic coast by February 6th and 7th.

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ASTRO FORECAST	ACTUAL WEATHER
The first of a series of bleak, raw winter periods is indicated from the 4th to 8th over the Eastern third of the nation. Beginning on or immediately after February 3rd, another blast of polar air will descend through the Midwest, dropping record subzero temperatures eastward over the northern borders and extending far southward to grasp Middle and lower Atlantic states in a glacial grip.	Freezing minima in the Dakotas ranged from 0° to —10° on the 3rd and freezing extended to the West Gulf Coastal areas. Snowfall preceding the cold wave over the 7th extended to the southern states, and on the morning of the 8th, localities of Louisiana and Mississippi reported one to two inches of snow.
Expect storm emergencies on February 8 & 9 east of the Appalachians over coastal inlands into northern New England . . . the triggering of all these elements at once on February 8th poses a classic pattern of northing cold air masses drifting eastward while a low pressure area pushes up the Atlantic coast.	A low pressure area with high winds east of Florida and Cape Hatteras. Another cold wave preceded by wind-blown snows was moving down through the midcontinent area at the end of the period. The 8th was the coldest period of the season, bringing a minima of —2° to New York City, —17° in Kennelon, N.J.
A mass of arctic air stabbing southward into Texas and all Gulf Coast areas on February 6 & 7th will invade Florida with the threat of destructively freezing temperatures in citrus-growing sections of the state on the morning of the 8th.	Freezing extended to all Gulf coastal areas during the first week of the period.
Respites from the abnormal cold in higher inlands will be transitory, especially in elevated areas of the northeast. Inland rivers will freeze solidly and ice on the Great Lakes will cake to record thickness.	Icebergs on the Mississippi, the St. Lawrence Seaway and the Great Lakes. An "ice-highway" on Lake Huron is used by caravans of cars and trucks to replace the regular ferry service, which is frozen solidly in the ice.
After the 15th, cold waves sweeping down from Canada on arctic gales will whip heavy snows over the Eastern and Southern shores of the Great Lakes region. Cold fronts centering over the Midwest will develop very high northwest wind velocities—also North of the Great Lakes—then drift Eastward.	Only light snowfall was recorded in the *western* Great Lakes area and the deepest cover was reported at 29 inches from Houghton & Marquette airports at Michigan. Up to 1-ft. of new snow *to the lee* of Lake Ontario kept the depth in that area to as much as 6 feet. Falls of 10″ in New England added to the already heavy cover and depths of 4-ft. were measured in N'thrn Lakes areas and Central Maine.
This pattern will be previewed on the 14th by heavy snowfall on the Eastern shores of Lake Michigan into Indiana and the Ohio Valley—and will penetrate into New York on the 15th.	On the 14th and 15th, snow was added to all susceptible areas of the Northeast, principally the Ohio Valley into New York, Vermont and Maine.
A primary low coming from the Pacific Northwest on the 19th will be preceded by rising temperatures as it moves eastward. Mountains of snow will pile up in Northwest elevations and in the Upper Midwest late on the 20th, continuing through the 21st.	Early period temperatures, which rose to near spring-like levels, cooled rapidly, lowering daily minima to new extremes at many stations from the Great Plains to the Atlantic Coast. Measurable precipitation was recorded in all sections of the Pacific Northwest and Idaho. A storm system worked its way from the Gulf up the East Coast area, producing rain and snow over the Mississippi and Ohio Valleys and nearly all the Nation East of the Mississippi River.

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This blizzard will strike into Michigan where it will mature; wind velocities will then increase to bury Pittsburgh and the storm will sweep eastward to pile snow deep in the canyons of New York on the late evening of the 22nd.

As the storm system moved up the East Coast, heavy snow fell in the interior mountain areas. Falls of 8″ were common in the Appalachians of the Virginias, and Canaan Valley, W. Va., had 19″ on the ground on the 19th. In New England the storm dropped from 5 to 14″ in southern interior areas. A low pressure area off the East coast; 2″ of snow turned to rain and froze overnight. One foot of snow fell in New England. Six New England states buried by the near-blizzard.
(But no blizzard of the exact nature and intensity forecasted occurred on the dates specified.)

Temperatures will drop sharply in the wake of this storm.

A 59° reading at St. Louis on the 20th was lowered to 22° in 3 hours from the cold air influx. On the 22nd, when Pellston, Mich., had an icy —35° low, new records for the date were also set from Albany, N.Y. to Little Rock, Ark., and Atlanta, Ga., with an 8° to beat its old reading by 11°! Record daily minima were set on three consecutive days ending on the 23rd at Louisville, Ky.

In northern sections East of the Appalachians, powerful gales, extremely complex, unpredictable storms, snow and ice on the 28th will permeate New England on March 1st.

Heavy snow squalls and high winds to the lee of the Great Lakes left up to 18″ of new snow cover in Western N.Y. End of the month snow depths ranged up to 55″ in Maine and to 40″ locally at Norwalk, Conn. Watertown, N.Y. received 19″ of new snow to measure nearly six feet.

ADDENDA

From January, 1963, forecast

ASTRO FORECAST	ACTUAL EVENTS
In astrology, influenza is characterized as a Saturnine *ailment. Anyone interested will find Saturn in 335° 43′ of geocentric longitude on February 19th. This position "triggers" a crucial degree of the great conjunction-eclipse of February 4, 1962 . . . this theory can be checked on the specified date and the effect traced to its probable source.*	*New York, Feb. 18—Influenza and respiratory infections have taken a heavy toll over the Eastern third of the nation since winter began. Over 250 deaths have been attributed to flu and pneumonia in New York City alone . . . Washington, Feb. 24—An epidemic influenza has rapidly spread from six to twenty-one states of the nation, health authorities reported today . . .*
February is likely to bring disastrous earthquakes *or volcanic belches from Mt. Vesuvius in Italy . . .*	*No volcanic belches occurred, but three earthquakes in Italy during Feburary. One destroyed 70% of the homes in Potenza, Southern Italy. A second occurred in a nearby town, causing additional death and destruction, and a third happened in Northern Italy. In addition, two severe earthquakes at Al Marj, Libya, on the 21st and 22nd made rubble of 80% of the homes, killed almost 300 people and injured 500. A third tremor occurred on the 23rd. (Al Marj is due south across the Mediterannean from Italy and in line with other quakes which occurred in Yugoslavia about the same time.)*

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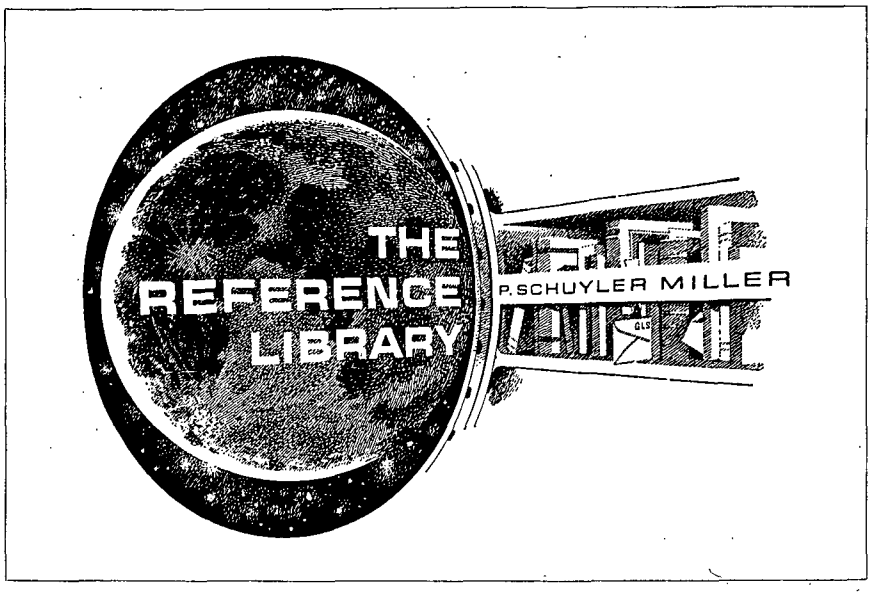

THEN AND NOW

From a vantage point just short of the First of Spring, 1963 is beginning to shape up as the Year of the Anthology Jackpot—with full apologies to Robert Heinlein. There are nine of them piled up in front of me at the moment, containing one hundred and twenty-five stories of varying lengths, and an idea I had that I could cover them all in one column has long since been filed with other insanities. However, four of them do illustrate the evolutionary processes that have been going on, changing the nature of the fantasy genre and absorbing it into today's science fiction.

These are: "The Unknown," Pyramid Books' collection from the late, great *Unknown Worlds*—No. R-851; 192 pp.; 50¢—edited by Donald R. Bensen with an introduction by Isaac Asimov; "Beyond"—Berkley Books No. F-712; 160 pp.; 50¢—with nine stories from the magazine of the same name; the annual "Best from Fantasy and Science Fiction"—Doubleday & Co.; 1963; 225 pp.; $3.95—edited this time by Avram Davidson; and the first of a new series of Doubleday collections, long overdue, "Analog I" edited by John W. Campbell—219 pp.; $3.95.

As Isaac Asimov notes in his nostalgic introduction to the Pyramid collection, *Unknown* died just twenty years ago, after three and a half years of publication. During those few years, cut short by the wartime paper shortages and distribution problems, it completely changed the nature of American fantasy writing, in ways that Dr. Asimov spells out with awe and affection. Ten years ago, *Beyond* made a pass at the same position but didn't make it. Today, some stories in *F&SF* vaguely echo the *Unknown* years—but that magazine is too different to be considered an imitator. I'd like to steal some of the Asimovian thunder and mix in some ideas of my own, with illustrations from these four anthologies.

Stories of the supernatural are as old as Mankind—or, at any rate, as old as language, if tool-making came before speech. They have always been at the framework of religion and folklore, and most people have believed them—for the religious stories were revealed truths, and the legends were the truths of the tribe. From childhood, in bogey-man threats and fireside stories, in Sunday sermons and family prayers, in the admonitions of the old and the threats of the more sophisticated, we were conditioned to react to certain themes, certain concepts, even certain words with fear and horror. The Nineteenth Century writers of Gothic novels knew very well what they were doing when they poured these keyed words and situations into their books, and so did the short-story writers from Poe's time on—because right down to our own time this conditioning process was still going on. Religion and superstitition between them, prepared us to be convinced by these fictions and to shiver in fear or delight at the sound of certain words. I am sure there are many places where this is still true.

Weird Tales represented the last of this old-style fiction of the supernatural. The words that H. P. Lovecraft and others deliberately dinned into their readers were the old keywords that to older readers still had the connotations of centuries before. To be terrified by a story about the Devil, you have to believe in the Devil—and there were still many who did. To shiver at the unmistakable signs of the werewolf or the vampire, you had to know—from childhood stories and dark whisperings in corners—what those signs were. Many first and second generation Slavic and Germanic immigrants did know, and had known for centuries.

And then the world changed. There was the first World War, and then the Depression. There was an era of science and an air of skepticism. The younger generation revolted against religious dogma and against the superstitions of the old people. Science fiction was one result of this change, and the kind of science fiction John Campbell began to publish here in Astounding—as it was then—set the pace. It is not surprising then that in 1939, with the first issue of *Unknown*, he introduced a fantasy of disbelief to replace the outmoded fantasy of lost beliefs.

Isaac Asimov says that where *Weird Tales* was grim, *Unknown* was impudent, and he is right. Donald Bensen, editor of the new Pyramid collection, says it was logical—and *he* is right. What John Campbell did was introduce the concept of science to the traditionally supernatural, and the result was the "typical" *Unknown* story.

One of the greatest horrors of belief in the supernatural has been the belief that it is arbitrary. The Greeks created a literature out of this, and

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the Christian church a diabolism. Gods and demons acted arbitrarily, whimsically, to suit their own unknowable moods and desires. Religions grew up out of the attempt to predict this behavior and to bribe or placate the deities and their agents into behaving reasonably, at least most of the time. The Greeks must have taken great comfort in the predictable humanity of their gods, and the Egyptians have dreaded the manifest inhumanity of the motives driving theirs.

But *Unknown* denied that the supernatural is arbitrary. It accepted the existence of demons and vampires and the like, then clapped on the scientist's—John Campbell's—stipulation that if a thing exists it must be governed by laws, even though we may not know what they are. The stories in *Unknown*, or most of them, dealt with the discovery and use of these laws. In the process, moldering themes took on new life and fantasy became a medium for intellectual fun and games. Beginning with *Unknown*, and continuing down to our time, readers allow themselves to be persuaded of the truth of premises that they once knew were true.

In the process, some themes—the whole field of psionics—have been taken over into science fiction.

Let's look at "The Unknown," now. Three of the eleven stories—L. Sprague de Camp's "The Gnarly Man," H. L. Gold's "Trouble With Water," and Anthony Boucher's "Snulbug"—have been reprinted over and over as classics, and Gold and Boucher went on to found their own fantasy magazines. As for the rest, in Henry Kuttner's "The Misguided Halo" the possession of a halo, a very serious matter religiously, becomes very funny but remains just as serious when a modern man gets one by mistake. In Nelson Bond's "Prescience," modern science is rapped on the knuckles for *not* treating the unknown scientifically. In "The Gnarly Man" the pure de Campian logic deals with the probable results of a very improbable Neanderthal man's surviving to our time. In "Trouble With Water" the old tale of the unwise wish is brought down to date with ruthless logic.

Fritz Leiber, in "The Bleak Shore," bridges the gap to old-style weird-adventure fiction by creating a *synthetic* mythology. He, like Clark Ashton Smith, Lovecraft, Howard and others before him, was making the transition from stories that required belief in the supernatural to those that got along with intellectual and conscious acceptance of a created supernatural, just as science fiction did and does feel free to create worlds and people them.

Boucher's "Snulbug" applied both logic and impudence to the obvious fact that there are demons and demons, and some of them are hardly worth calling up. Manly Wade Wellman brought Poe face to face with a vampire. Robert Arthur, in "Mr. Jinx," gave his demon a logical place to work, in the shady world of the crooked fight racket. Malcolm Jameson, in "Doubled and Redoubled," gets at another aspect of the clumsiness of magic, and Fredric Brown, presaging a long career in such impudence, brings a nine-year-old face to face with Satan—poor Devil.

There remains one story that makes a nice transition to what *Beyond* did ten years later. Theodore Sturgeon, with a fine comic hand that you would hardly recognize today, gives us the story of a man who loses Tuesday—"Yesterday Was Monday." He soon finds out that he is merely an actor who has wandered onto the wrong stage—that all "our" world is a play, staged for entities unspecified. Enjoy it; it's fun. Then pick up "Beyond" and see what Algis Budrys made of the same theme in "The Real People"!

There's no impudence and no comedy in this: what is a gay gimmick in the Sturgeon story is deadly serious to Fred Delman when he finds that he can change reality. In ten years readers—though apparently not enough readers—have learned the trick of going along for the ride and accepting the author's premises. "The Real People" can be played straight—and is, and is the best story in the collection.

There's impudence here, too. From Ray Bradbury, whose "The Watchful Poker Chip" is merely a bizarrity. In Frederik Pohl's "The Ghost Maker" and Fredric Brown's "Double Whammy." There's a faint, Maidenform reincarnation of Greek mythos in "The Beautiful Brew" by James Gunn. A magic ring gives a family uncomfortable talents in Wyman Guinn's "The Root and the Ring," another good one. Jerome Bixby produces a comedy of Hellish errors in "Can Such Beauty Be?" and Winston Marks introduces another Satanic bargain in "I'd Give a Dollar". Sturgeon is here, again, with the nastiest kind of a horror-magic story in "Talent," utterly unlike his comedy in *Unknown*. But except for Budrys, Pohl, Brown and Sturgeon, these stories from *Beyond* are rather self-conscious. They are best when they are not trying to be like *Unknown*.

With the twelfth "Best from F&SF" we are down to the present. Here, with both fantasy and science-fiction themes, it is strictly up to the author to sell his premises. Karen Anderson does so with a pride of totally un-Greek sphinxes in "Landscape with Sphinxes." J. G. Ballard lures you into a nightmare in "The Garden of Time." Joanna Russ brings freshness to a period vampire story in "My Dear Emily".

The *Unknown* impudence is still with us, too. Avram Davidson clobbers you with it, yet makes it utterly plausible, in "The Singular Events Which Occurred in the Hovel on the Alley off of Eye Street." Ron Goulart needs it for "Please Stand By," whose hero is an elephant on national holidays. Sasha Gilien makes good use of it in "Two's a Crowd," with contending spirits controlling a harassed boy. There's a touch of it in Will Stanton's "The Gumdrop King," though that is more concerned with the infallible logic of childhood. And

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there's a bit in just one of the science-fiction stories, Joseph Dickinson's "Three for the Stars," in which a very strange message is brought back from Mars.

The rest of the *F&SF* science fiction is pretty serious and intense. Theodore L. Thomas, in "Test," describes drivers' tests as they may have to be. James Blish's "Who's in Charge Here?" is strangely documentary. Vance Aandahl's "When Lilacs Last in the Dooryard Bloomed" makes the aftermath of atomic holocaust both terrifying and compassionate. Edgar Pangborn draws out the essential humanity of people past or future in "The Golden Horn," a story of a future in hills I know well. Brian Aldiss' "A Kind of Artistry" absorbs the lycanthropy theme of legend into the biology of the future and wraps it up in nightmare. Kate Wilhelm's "The Man Without a Planet" is a tear-jerker and Terry Carr's "Hop-Friend" creates a very strange world.

And now "Analog I". John Campbell insists in his introduction that he has no axes to grind or trends to set here; these are stories published to give readers the fun of stretching their attitudes and imaginations. And this is, of course, precisely what *Unknown* did for them twenty-odd years ago; it broke the centuries-old conditioning which had frozen our attitudes toward supernatural themes, and let our minds explore.

One, maybe two stories would have been considered fantasies twenty years ago, though I don't think either would have been in *Unknown*. I don't think they would have been in *Astounding*, either. Our growing sophistication has enlarged some of the pigeon-holes in which we keep stories, and eliminated others. Leigh Richmond's "Prologue to an Analogue," for example, tells what happens when the witches of the world unite their powers. Winston P. Sanders' "Barnacle Bull" is a quite straightforward story about creatures that live in the vacuum of space.

Proud of our New Frontier? Then see what you think about New Frontier values applied to the heroes of the Alamo in T. R. Fehrenbach's "Remember the Alamo!" Rather contemptuous of the law? Then, in Lloyd Biggle's "Monument," see what the concept of law can do to save a people. Confident of the wisdom of computers? Read Christopher Anvil's "The Hunch," and see what a machine can't do.

Or, just for the fun of it, solve the mystery of the nation-wide poisonings in Teddy Keller's "The Plague," outwit a belligerent alien with Gordon Dickson, guitar and all, in "Sleight of Wit," or beat down the defenses of those other proud but bull-headed aliens in Sterling Lanier's "Join Our Gang?"

And, some time, reread "Frankenstein"—a mind-stretcher of its day, but oh how we've changed!

PROFILES OF THE FUTURE
by Arthur C. Clarke
Harper & Row, New York. 1962.
235 pp. $3.95

I don't know the ethics of introducing a review of one writer's book with a quotation from a contemporary and sometime competitor, but it's necessary here. The statement that Judith Merril called "Merril's First Law of S-F Psychodynamics" in her "Year's Best S-F: 1961" sums up perfectly the special touch that Arthur Clarke has given to this collection of factual and conjectural pieces from a variety of magazines.

Merril's First Law: "For every change in outlook, there is an equal . . . shift in insight."

This matter of fresh outlook is one of the most striking characteristics of George Gamow's popularizations of physics and astronomy. In the nineteen articles collected—and I suspect somewhat rewritten—here, Clarke shows the same talent. In the process, he bolts together a sturdy framework for many of the standard themes and gimmicks of science fiction, and points to trails that SF writers haven't tried to explore.

Small wonder that Arthur C. Clarke was the 1961 winner of the Kalinga Prize for popularization of science, awarded annually by UNESCO.

Indeed, early in the book, the author offers a useful aphorism of his own, and goes on to justify it with ample evidence from the works of the false prophets. "The real future," he points out, "is not *logically* foreseeable." Mutant discoveries of the sort that have led us into antibiotic medicine, into solid-state physics, into radio astronomy, have repeatedly thrown the smooth course of logic into confusion—and will again. If we get any of the staples of current science fiction—controlled gravitation, a faster-than-light energy transfer, "cyborgs"—they will come in this way. Stumbling over this block, most past prophets have failed because of lack of imagination and lack of daring, because they could not foresee the breakthrough and were too cautious to apply the rule of exponential expansion to their societies.

Clarke himself is optimistic about many wonders that most orthodox scientists still consider fantasy. The whole book is, in a sense, a fast-running commentary on the "science in science fiction," from invisibility to girls in golden atoms to space warps to thinking machines . . .

"Profiles of the Future," in school libraries, should start more arguments going and stir up more original thinking than anything I've seen in a long time. A very good teacher could use it as the text for an after-school, extra-credit course for top science students, who would be expected to fight every page of the way and to add their own changes in outlook to the author's.

THE WORLD WITHIN
by Adam Lukens
Avalon Books, New York. 1962.
222 pp. $2.95

Adam Lukens—and I don't even know whether the name is his own or a pen name for someone more familiar—is not one of the great practitioners of present-day science

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fiction, but he hasn't done a really ordinary book yet. Every one of his five originals for Avalon has had a fresh approach to an old plot that gives this pretty stolid line a needed boost.

The present book is his second about Abe Kinosky, Death Examiner for the Carnival Guild in a galactic future when the star-worlds are peopled by the far-flung spawn of mankind, and the societies they have reared are marvelously intricate. Here, on leave and pursuing an eloping daughter, Dr. Abe finds an Assassin following the girl and her Carnie partner—and clarifying that problem leaves him up to the throat in a far more important one: that of the mirrors that are swallowing people up, while the planetoid governor doggedly refuses to see what he can't or won't believe.

The unraveling of the mystery is carried out on a reasonably legitimate basis; you may guess the identity of the individual behind the vanishings. But you are unlikely to anticipate the rich bits of incident and attitude with which the author builds his world and his people. No message . . . no Merrilian twist of insight . . . but you are drawn into the Carnie world as the Carnies have been drawn into their mirrors.

A GUN FOR DINOSAUR
by L. Sprague de Camp
Doubleday & Co., Garden City, N.Y. 1963. 359 pp. $4.50

This must represent just about the last grain spirits to be distilled from the de Campian mash. The stories included appeared in a variety of magazines between 1952 and 1957—a few of them here—and four have been in anthologies. One, in fact, is in a current paperback, "The Weird Ones."

Most of the fourteen stories are also distinctly late-model de Camp, commenting on the current scene—and especially the suburban, or more properly *exurban* scene—by projecting it into the future, where its "things of custom" appear in all their incongruity. As the plot grows simpler and simpler, the settings and commentary carry more and more of the load, in the manner of an off-Broadway play. And there will be those who say the author has written himself into most of his rather put-upon heroes-in-spite-of-themselves.

The title story surely needs no introduction now. From the moment it appeared in *Galaxy*, seven years ago, it has been one of *the* classic time-travel stories invading the years of the dinosaurs. "Aristotle and the Gun," here at about the same time, is less well known and even better in its recreation of Aristotle's Macedonia as seen through modern eyes, and its twist in the alternate time-track theme.

The next two sections, entitled "Gadgets and Projects" and "Suburban Sketches," intermesh in many respects. It is probably not true that the author had to leave Media when some offbeat mainliner discovered the "Parthia" of these yarns, but on the other hand he may have taken to planting extraterrestrial plants in his garden, in the manner of "Gratitude," or putting up ET's over the holiday weekends, as do the exurbanites of the also familiar "A Thing of Custom." The scientist of "Judgment Day," who judges mankind as it has judged him, lives not very far away.

Lack confidence? *Don't*—as "The Guided Man" did—let the operators of the Telagog Company take over for you. Need a baby-sitter for your egg? Then make sure—as the Yerethian couple of "The Egg" did not—that you have correlated your calendar properly with the terrestrial one. Fed up with the teen-age savages who congregate—in Pittsburgh the word is "loaf"—in your neighborhood? Then stay out of the viciously adolescent-ridden future of "Let's Have Fun."

One of the best stories in the lot—in part because it is so unlike the rest—is "Internal Combustion," which points out that used-up robots may become bums, just like used-up people. "Throwback" plays with the possibilities of back-breeding people to recreate our pre-*Sapiens* forebears—in this case a well-meaning *Gigantanthropus* who gets a short-lived job in pro-football. "Impractical Joke" transplants an obnoxious everyday type to a far world, with inevitable results, and "In-Group" suggests that on the other side of space archeologists may release some of their inhibitions. "New Arcadia" projects a colony of French idealists across space to a world where they make some of the discoveries about human nature that their compatriot, Jules Verne, fitted into his posthumous "Survivors of the *Jonathan*."

Finally, there is a low comedy of the future entertainment world, entitled "Cornzan the Mighty." Conan, Tarzan, Flash Gordon and Jungle Jim are properly demolished.

RECENT REPRINTS

CHILDHOOD'S END
by Arthur C. Clarke
Harcourt, Brace & World, New York. 1963. 216 pp. $4.50

Yep—that's the price. This is one of Clarke's finest, which means very fine indeed, but in 1953 you could have bought the Houghton Mifflin first for $2.00 or the simultaneously published Ballantine paperback for 35 cents, and the Ballantine edition was reissued in 1960 at the same price. You explain the economics of book publishing to *me*, please.

THE STARS LIKE DUST
by Isaac Asimov
Lancer Books, New York. No. 74-815. 1963. 192 pp. 75¢

This seems to be the second paperback edition of the book that Doubleday published just ten years ago and *Galaxy* had—as "Tyrann"—two years earlier. It's a novel of galactic intrigue set in the early years of the human empire that culminated in the "Foundation" stories.

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foetuses—the young, rapidly dividing, foetal type human tissue proved extremely susceptible to thalidomide's effects. But . . . cancer cells are characteristically rapidly-dividing foetal-type cells! And at least one case is known in which a terminal cancer patient, no longer getting relief of pain from even massive doses of morphine, was given thalidomide . . . and the cancer vanished.

There now appears a totally new type of problem for biochemists to study. Thalidomide does not affect animals as it does human beings; in animals it is not a sedative, nor does it cause foetal damage. Presumably, then, it would not affect cancer in animals either. Then this would be one known instance of a drug which has therapeutic effect in humans—which would never be discovered by animal testing!

Could The Cure for major human ills be already known substances which, when tested on animals, had no effect whatever and have, therefore, been abandoned as useless? Could a drug curing insanity be detected by test on non-intellectual animals?

Dear John:

I don't know who Mr. Name Withheld As Requested (writer of the first letter in the September Brass Tacks is but I can't let his slur on American Science pass.

All the way through my graduate training, from beginning to end, I wrote science fiction under my own name; and my school, my teachers, and my fellow-students knew all about it. I underwent some good-natured ribbing (I still do) but I was given no trouble. Some of my stories pointed some satirical fingers at science and in 1948, I wrote a make-believe scientific paper on a fake compound that dissolved before water was added. It was published the *same month* I came up for my Ph. D. union card, and the examining professors had some fun with me as a result, but it was gentle fun, and I got my union card.

I joined a University faculty and for years I continued to write science fiction under my own name. My fellow faculty members knew about it, and there was some more ribbing, but nothing happened to me. I wrote straight science books and, as far as I know, the publishers never objected to the fact that I wrote science fiction also; they remarked about it on the jacket cover.

In other words, American Science is as tolerant of eccentricity as any other institution in the world; in fact, *more* tolerant and the toleration extends to those without the union card, too. It did in my case. American Science is not infinitely tolerant, of course; no institution is. I think, though, that being more tolerant than any other institution I can think of is quite enough. And you may sign my name.

ISAAC ASIMOV

■ *This is one other man's experience . . .but it must be pointed out that Dr. Asimov does have his "union card"!*

Dear John:

Looking back to the issue of May, 1961 and that is not too far back, the way the postal system works here, your Brass Tacks asks for anyone from Zanzibar—how about Laos, even farther from New York?

That first sentence is not too far off, either, since just a few weeks ago, I received a stack of some eighty magazines, dating back to October, 1961, sent by surface mail, of course. I guess it must have come by slow sea slug.

Your editorials always interest me greatly, and among them I include those which dwell upon the distinction between technicians and "pure" scientists. Among that stack of magazines that I mentioned was the Winter, 1962 issue of the *Yale Review.* (Even though I am University of Pittsburgh, 1931, I still find this interesting.) On page 197 is an article by Joseph Fruton, entitled "The Aims and Values of the Sciences." If you have not already read it, you may find it interesting, as in many ways it ties in with some of your comments.

I regret I cannot talk of the existence of a sf fan club in Luang Prabang—the number of English speaking individuals here is quite limited, and with the withdrawal of the US military, it is cut down to four Americans, one or two French and a very few Lao. Up to the beginning of this year, the French "roman d'anticipation" were available in the bookshops of Vientiane, but the sale of these has been discontinued, from lack of custom. Incidentally, practically all of these are still in the space opera style of our 30s—and, incidentally, I do not find this entertaining. However, very few of them would repay translating for an American audience.

We do have one bookstore in Vientiane which handles American magazines—Analog and *Galaxy, Amazing* and *Wonder, ESF* and a variety of the pocketbooks. However, the latest crisis and the cancellation of the convertibility of the Lao currency has made it difficult to import such items, and no new pocketbooks have arrived for quite a few months. When I get back home a few years from now, I should have quite a time catching up on all the back stories.

I can qualify as an oldtimer in the sf game—I can remember the Gernsback stories in the *Scientific American* in 1917, and have a complete file of *Unknown*: I have read all the sf magazines since the date of their origin—or at least all that I could find. I started before that on Haggard, Janvier, the lesser known works of Bram Stoker and many others of the same genre.

Guess that's about it for this time. If there is anything I can do for you from this part of the world, just let me know.

ALLEN D. KERR
Luang Prabang, Laos

■ *But Laos doesn't begin with a z! Anybody been complaining about trouble finding a newsstand lately around here, though . . .?*

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EDITORIAL

(Continued from page 6)

extremely unusual in the Universe.

You see, what we've overlooked is the fact that we live on *one component of a binary planet.*

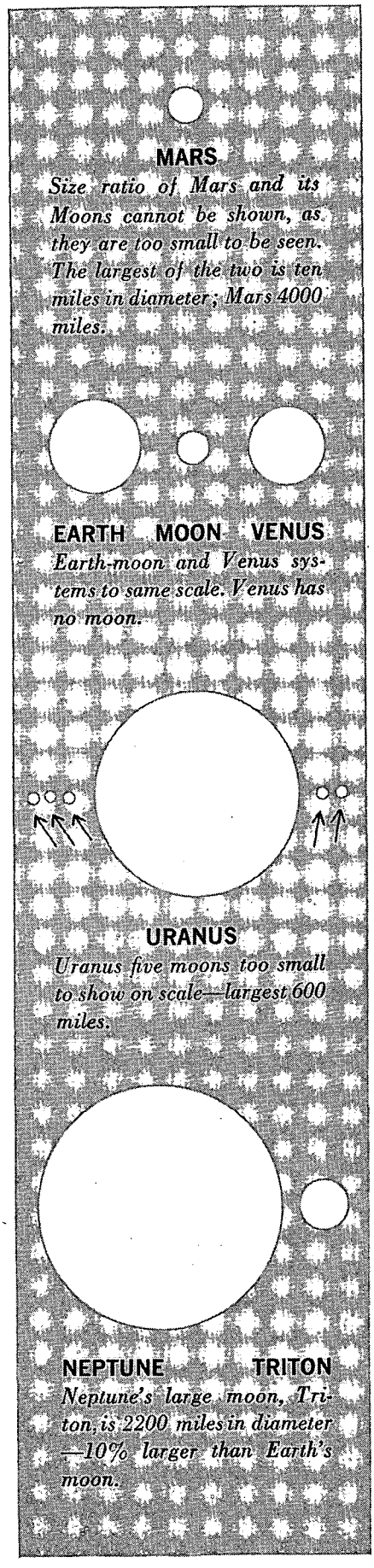
What are the chances of another binary planet like the Earth-Moon system circling another adequately long-lived star at a distance producing a suitable temperature on a clear-atmosphere planet?

Venus has long been described as Earth's twin; with a diameter of 7,500 miles to Earth's 8,000, surface gravity eighty-five per cent of Earth's, at about two thirds Earth's distance from the Sun—it sure looked as though Venus would be very similar to Earth.

The radio astronomers, several years ago, began getting data on the surface conditions on Venus—and the answers were so unbelievable that they were accepted only with the greatest reluctance. That Venus, Earth's twin, should have a temperature that would melt lead was incredible. The fantastically high temperature readings were ascribed to some anomalous radio frequency emission from the planet.

Optical astronomers couldn't penetrate Venus' cloud layer well enough to get even so much as data on the rate of the planet's rotation, let alone get any useful surface detail. The spectroscope, ordinarily able to answer many questions that direct observation couldn't, failed completely on Venus; whatever the planet's rotation rate, it was so slow that the spectroscope couldn't detect it. Whatever the atmosphere of Venus contained, it wasn't anything we could be sure of. Carbon dioxide . . . probably. Water . . . no readable indications. The planet of mystery . . .

Radio astronomers, working at enormously longer wavelengths than those used by optical astronomers, were able to get signals from Venus that most probably did eminate from the actual solid surface, not from the clouds above. But their data came up with insane answers! Earth, if it were at Venus' distance, should have an average temperature of 150°F. That Venus could have a temperature so enormously higher . . .


MARS
Size ratio of Mars and its Moons cannot be shown, as they are too small to be seen. The largest of the two is ten miles in diameter; Mars 4000 miles.
EARTH MOON VENUS
Earth-moon and Venus systems to same scale. Venus has no moon.
URANUS
Uranus five moons too small to show on scale—largest 600 miles.
NEPTUNE TRITON
Neptune's large moon, Triton, is 2200 miles in diameter—10% larger than Earth's moon.

Repeated checks gave the same answers. And tests for radio frequency spectrum responses due to water vapor—it has spectrum lines in the microwave region, as well as in the "optical" range—gave negative answers.

We've known about the "greenhouse effect"—the ability of an atmosphere to trap solar energy by allowing short-wave visible energy in, but blocking the re-radiation of longer wavelength heat—for a long time. But never in the degree Venus now turns out to have! Venus has a "greenhouse" that could be used for a home pottery kiln, practically—certainly not as either a greenhouse or even a home bake-oven!

The clouds appear to be a solid fifty to seventy-five mile thick layer of the most vicious kind of industrial smog-type components; complex hydrocarbons and assorted mineral acid vapors.

We on Earth here tend to think of nitrogen as an "inert ingredient" in an atmosphere. Completely wrong! Earth now appears to be the only planet in the Solar System on which nitrogen is free in the atmosphere! On the giant planets—Jupiter, Saturn and the rest—nitrogen is linked with hydrogen in ammonia. And to form great mountains of a solid metallic substance that doesn't exist as free metal on Earth—ammonium metal, NH_4. (Under the extreme pressures in the giant planets' atmospheres, $NH_3 + H_2$ is less stable than the solid metallic form, NH_4.)

On Mars, nitrogen is linked up with oxygen in nitric oxide. On Venus, seemingly, nitric oxides are present also. (And, incidentally, in the Sun's atmosphere, nitrogen is one of the few elements that can remain in combination even at solar temperatures—that everybody-knows-its-inert element combines with carbon to form cyanogen—CN-

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can be detected in the solar spectrum.)

Down on the surface of Venus, under the tens of miles of smog, the conditions closely approximate the conditions at the bottoms of Earth's deepest seas in several important respects. The darkness is absolute; there is no light whatever. There is moreover, neither weather nor climate; the immensely thick insulating blanket prevents all temperature fluctuations from day to day—even with Venus weeks-long day—or from year to year. Down there, there is only an unending, searing, black calm.

Earth has jet streams in its atmosphere—stratosphere, to be accurate—which roar around the planet at hundreds of miles an hour, constituting a major heat-distribution mechanism. Venus has jet streams, too—but with the immense depth of atmosphere, and the enormous heat differentials resulting from the very slow rotation, Venus' jet streams apparently achieve wind velocities of thousands of miles an hour.

Those stupendous winds high in Venus' atmosphere do not, however, mean that the surface layers of that atmosphere are disturbed; Earth's jet stream are only a few miles above Earth's surface; yet immediately under a 250-mile-an-hour jet stream there may be the dead calm of a hot summer day.

Venus' atmosphere supports completely opaque clouds some sixty miles above the planet's surface, Mariner II reported. At a fifty mile altitude above Earth, by current definition, a man is legally in space. And certainly it's far beyond aerodynamic flight support!

To be able to support opaque clouds at sixty miles, Venus must have many, many times Earth's atmosphere. If it matches Earth's cloud-layer density at sixty miles, remember that Earth's atmospheric density doubles, approximately, every five miles you go down. If Venus' doubles for each six miles, then Venus must have several hundred times as much atmosphere as Earth.

And this is Earth's "twin planet"?

All the work the geophysicists, cosmologists and astrophysicists have done during the past century must now be massively re-evaluated. In computing the way a planet gains or loses atmosphere, they have, naturally, checked their computations against the facts concerning the available planet—Earth.

It turns out they've been checking their figures against a planetary freak. Venus, nearly exactly Earth's size, retained scores of times as much atmospheric gas—and if anything, Venus is smaller, and we now know it's also very much hotter. Earth's atmosphere should be at least two whole orders of magnitude greater than it is!

Mercury, of course, has no atmosphere; as close to the Sun as it is, and as small as it is—almost exactly three thousand miles in diameter—it couldn't retain gases.

Of the other eight planets, only three have transparent atmospheres—Earth, Mars and Neptune. (Pluto is unknown, but almost certainly clear.) Neptune's is clear because the planet's temperature is so low that nothing but hydrogen, helium and neon remain gaseous; there's nothing to make a condensable vapor at those temperatures. Mars' is clear because of its extreme thinness.

And Earth's is clear because of its extreme thinness.

Every other major planet capable of retaining atmosphere is a clouded-atmosphere, or opaque-atmosphere planet.

Earth's a freak.

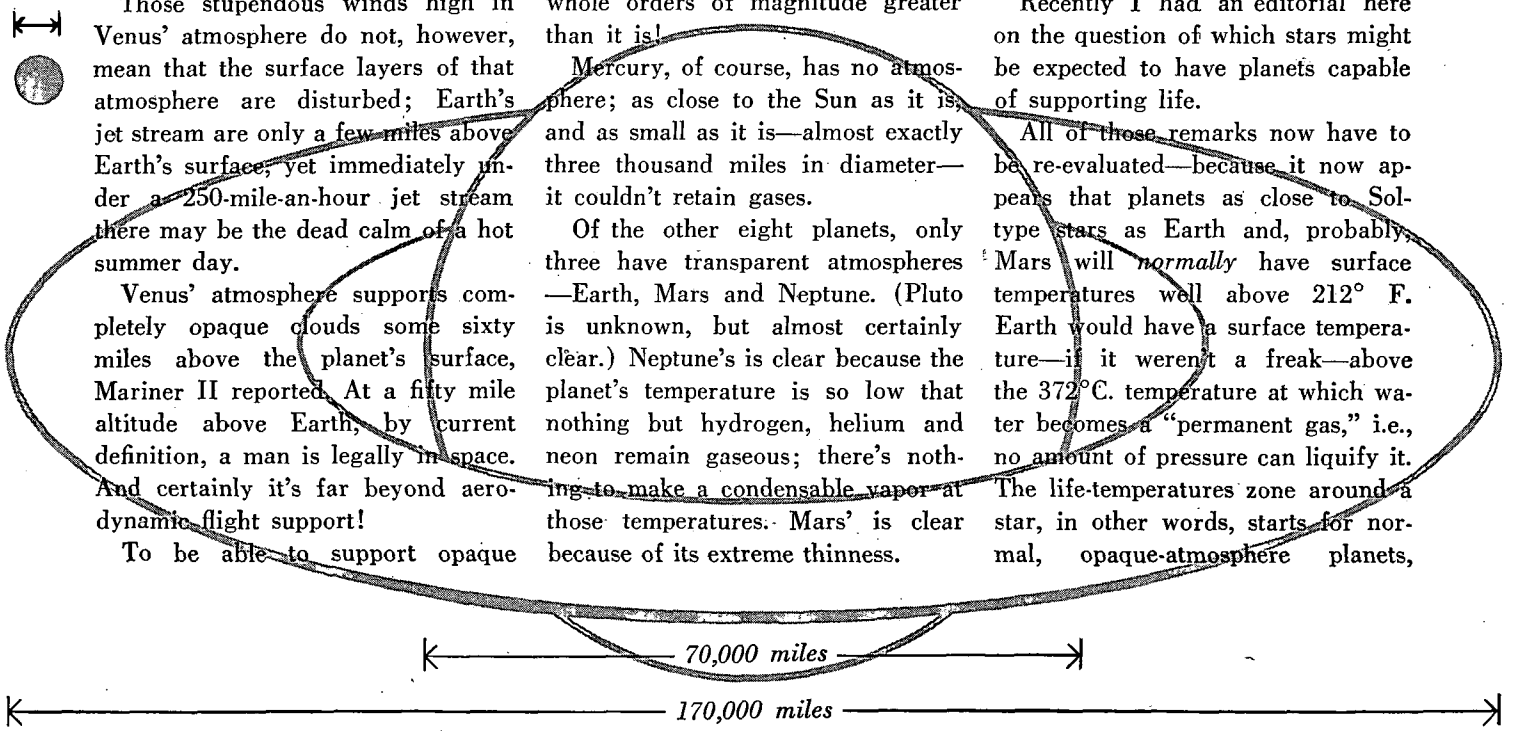
In the past, we've guesstimated the probable surface temperature of other planets by supposing Earth were in the orbit of the other planet. In Venus' orbit, Earth would have a temperature of about 150°F. In Mars' orbit, Earth would have a temperature about —40°F. In Jupiter's orbit . . .

And now that we know Earth is in fact a freak, how about trying Venus as the sample—what of Venus-type opaque-atmosphere planets at those different distances? That would make much more sense, since, with the exception of Mars, the others we're interested in *are* opaque-atmosphere worlds!

On the basis of Venus actual surface temperature, *Jupiter and Saturn both may have a liquid-water surface temperature.*

Recently I had an editorial here on the question of which stars might be expected to have planets capable of supporting life.

All of those remarks now have to be re-evaluated—because it now appears that planets as close to Sol-type stars as Earth and, probably, Mars will *normally* have surface temperatures well above 212° F. Earth would have a surface temperature—if it weren't a freak—above the 372°C. temperature at which water becomes a "permanent gas," i.e., no amount of pressure can liquify it. The life-temperatures zone around a star, in other words, starts for normal, opaque-atmosphere planets,



SATURN

Both Jupiter and Saturn show marked bands or belts of clouds around the planet. Saturn's rings show light and dark divisions giving the effect of a series of concentric rings. The rings have almost no thickness, but tremendous breadth.

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much farther out than Earth, and extends to the region where even an opaque-atmosphere heat-trap can't keep the planet warm.

There is, however, one slight difficulty.

Life evolved on Earth, and we've had a lot of discussion and studies to show that life would, by the nature of things, tend to evolve on any planet having the necessary temperature range.

Sorry . . . try again! On any *freak binary* planet having a clear atmosphere, and also having gravity enough to retain light gases such as the hydrogen necessary for making water.

One of the strange anomalies of life in Earth's oceans is that the Antarctic Sea is by far the most densely populated body of water on Earth. It certainly seems improbable that life should congregate most thickly in that icy cold zone of long, bitter nights.

The reason depends on the fact that life must have three absolute essentials; light, for energy input; fluid for chemical transport medium; and minerals to be transported and interacted.

The ocean deeps have the greatest concentration of minerals; there, there are the minerals needed for abundant life . . . but there is no light, so none of the photosynthetic life forms can get the energy to live, and only a very few scavenger forms live on detritus raining down from the upper levels.

In the tropical waters, where light is brilliantly and regularly available, and the water is warm, which tends to speed biological processes . . . there is so acute a shortage of minerals—particularly phosphorus—that the microscopic plant forms on which the whole life chain of the ocean depends cannot grow.

But in the Antarctic Sea, the deep waters from the ocean floor, heavily laced with minerals, are forced up to the ocean surface—into the zone where light, water, and minerals can be found simultaneously. The sea swarms with life!

An opaque-atmosphere planet presents a not-entirely-dissimilar problem. At the surface of the planet are minerals; at the top of the atmosphere is light energy. But is there any way for the two ever to get together with a usable fluid?

In the case of Venus, we have evidence that there is no water, even in the deep layers of the atmosphere, for even microwave radio astronomy hasn't detected it. But assume a Venus-like planet that did have water vapor.

Now the top cloud layers of Venus have a temperature around sixty degrees below zero F.; the surface has a temperature around eight hundred degrees above zero; there must be a region somewhere in-between where water can exist as a liquid.

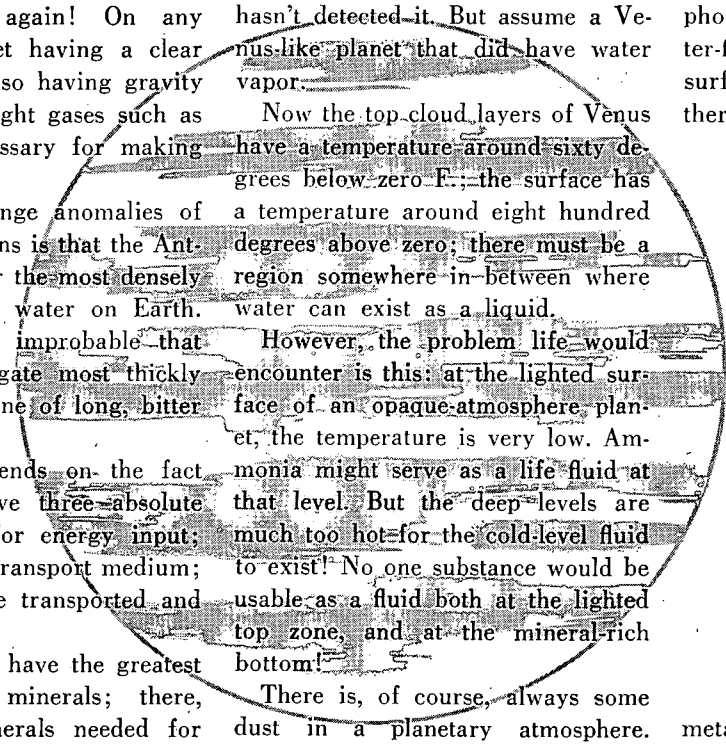
However, the problem life would encounter is this: at the lighted surface of an opaque-atmosphere planet, the temperature is very low. Ammonia might serve as a life fluid at that level. But the deep levels are much too hot for the cold-level fluid to exist! No one substance would be usable as a fluid both at the lighted top zone, and at the mineral-rich bottom!

There is, of course, always some dust in a planetary atmosphere. How about dust being carried up from the mineralized surface levels to a fluid level far enough up for photosynthesis?

Up through anything from fifty to five thousand miles of opaque atmosphere, you mean? Remember, the bottom of an opaque atmosphere is, by the nature of the processes, calm. Mighty little dust-stirring there, where the dust exists to be stirred. Venus' upper lighted levels may well get more dust-input from micrometeorites falling from space than from stragglers who climbed fifty miles against gravity to reach sunlight.

In Jupiter's case, the outer layers are definitely known to be ammonia clouds, laced with metallic sodium. But the opaque-atmosphere model suggests that Jupiter's surface temperatures must be in the liquid-water range, or perhaps even higher. (If those opaque atmospheres trap solar heat that effectively, they must also block the escape of radioactive heat to a fantastic degree. And the quantity of potassium-40 in the mass of Jupiter would generate *quite* a little heat!)

Jupiter would then be a case of a planet whereon only an ammonia-fluid life form could exist in the photo-active levels—and only a water-fluid life form could exist in the surface layers! And inasmuch as there is strong evidence for free metallic sodium and metallic ammonium in Jupiter's clouds, neither of which can coexist with H_2O, we can drop that problem.



JUPITER

Scale diagram showing size ratio of Jupiter to the four major "Galilean" moons. So called because Galileo was able to see them in his primitive telescope.)

So . . . *can an opaque-atmosphere planet permit the evolution of living forms?*

Evidently life-as-we-know it would be unable to find the three necessities in any place simultaneously.

Now the mass of matter in the Universe is practically pure hydrogen, with some helium, and traces of contamination by heavier elements. Planets, because of their small gravitational fields, lose practically all the gases, and retain only the trace contaminants; Jupiter and Saturn have made out somewhat better, but even they must have lost something like ninety-eight per cent of the original gaseous mass from which their remaining matter was gathered.

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The most abundant elements seem to be—after hydrogen and helium, of course—the lighter elements, which are the ones first manufactured in stellar cores, and iron, which is the lowest-energy nucleus and the true ash of stellar thermonuclear reactions. (Energy is *released* in building all elements up to Fe-56; energy is *consumed* in building all elements above Fe-56. U-235 fissions and yields energy because it is far above the Fe-56 least-energy-nucleus structure, and breaking down toward the lighter elements yields energy.)

There are three elements that can't exist in stellar thermonuclear cores—lithium, beryllium and boron have no isotopes that can maintain existence in a thermonuclear core. Deuterium—"heavy hydrogen"—can't remain either. These four react more rapidly, at a lower temperature, than does hydrogen—so they go first and fastest.

The element next after boron is carbon—and carbon, oxygen and nitrogen are the three elements taking part in the "solar Phoenix" reaction, important thermonuclear processes in stellar mechanics. After oxygen comes fluorine—which has a single isotope, F-19, and while it's stable, it doesn't stand up well in a thermonuclear core. Then we get to neon, sodium, magnesium and aluminum.

In the raw material of planets, hydrogen, carbon, nitrogen and oxygen play crucial roles. Hydrogen and oxygen are the most abundant—so far as Solar System indications go!—with nitrogen and carbon less so. Oxygen can combine to form oxides of the rocky types with silicon, magnesium, and aluminum; in addition, hydrogen oxide—water—is, of course, common.

Nitrogen can combine either with oxygen or hydrogen—but at planetary temperatures, neither nitrides of the metals nor the cyanogens seem to be favored.

In Earth's atmosphere, nitric oxides are constantly being formed by solar electron bombardment, UV activity, and by electric sparks—lightning—in the atmosphere. And the biological activities of organisms are greedily consuming every molecule of the combined nitrogen they can get hold of. If it weren't for the biological activities, nitrogen oxides would accumulate in Earth's atmosphere.

In Jupiter's atmosphere, the immense excess of hydrogen swept all the oxygen out of the atmosphere; there, the enormous pressure makes the reaction $N_2 + 3H_2 = 2NH_3$ strongly favored.

On Earth, the free oxygen in the atmosphere tends to favor strongly the production of carbon dioxide; on Jupiter, the hydrogen excess favors the formation of carbon tetrahydride—methane, CH_4.

In each case, the atmospheres of the planets grow almost solely from the interactions of the four lightest thermonuclear-stable elements, hydrogen, carbon, nitrogen and oxygen.

The thermonuclear probabilities make it very unlikely that any other gases could be important on planets elsewhere in the Universe. Fluorine, the only other first row of the periodic table element, is very low in cosmic abundance. (The helium nucleus of mass number 4 seems to be the stable unit of construction for the lighter elements. Oxygen-16 is four times He^4; carbon-12 is three times, and neon-20 is five times. Fluorine-19 is not favored. Nitrogen-14, halfway between C^{12} and O^{16} and one of the major steps in the "solar Phoenix reaction" is favored.)

Venus' smog-type opaque atmosphere appears to be made up of what might be expected from those interactions. Evidently the planet—somewhat lighter than Earth and nearer the Sun's heat and ionization—lost nearly all its hydrogen while forming. Most of its oxygen combined with rock-forming elements. The remaining hydrogen, nitrogen, carbon, and oxygen assorted themselves into a system partway between the ammonia-methane system of Jupiter, and the nitric-oxide system of the still-lighter planet Mars.

Start with the hydrocarbon-ammonia atmosphere of Jupiter, and reduce the hydrogen content while leaving the other gases fairly constant. The ammonia will go over to nitrogen oxides, the carbon will go from methane, CH_4, to CO and CO_2, as oxygen becomes relatively dominant. The interaction of the resulting mixture of nitrogen and carbon oxides with methane will lead to the production of higher, more complex hydrocarbons and hydrocarbon derivatives. There will be complex aldehydes, alcohols and organic acids, with assorted attached nitro and amine groups.

These reactions will be driven by the high-energy radiation of the Sun—the ultraviolet quanta, impacting electrons and protons, soft X rays, et cetera, reacting on the uppermost layers of the planet's atmosphere.

Our own atmosphere shows traces of nitric oxides from solar bombardment at the uppermost levels, for instance.

Now Venus has so high a surface temperature that there is no usable fluid at the surface. But—suppose Venus had a bit more water, and were moved out to Jupiter's distance. We would then have a curious possibility for a totally new kind of life-system.

That process of radiation-excited reactions between the atmospheric hydrocarbons and nitric oxides will tend to produce fairly complex organic compounds. Radiation-produced amines and radiation-induced acids will combine on contact to form larger and more complex molecules—which will tend to sift downward under gravity.

These complex organic compounds can serve as food for living cells that operate on a fermentation basis! It would be possible, in other words, for a life-system to evolve on an opaque-atmosphere planet, *with no equivalent of plant forms!* The planet's atmosphere itself would serve to fix radiant energy in the form of organic compounds, and the slow trickle of resulting compounds downward to the fluid-mineral supply at the surface would make life possible in

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total absence of light energy input.

The resultant surface life would *all* be "animal," in the sense of being energy-releasers rather than energy-fixing organisms. Like the living forms at the bottoms of our ocean deeps, the whole system would be dependent on the thin rain of organic detritus from far above. Living in absolute darkness, on very thin rations, they would, in effect, be smog-eating organisms. Their output of carbon dioxide, nitrogen and water would return to the atmosphere, filtering slowly up through the vast blanket of opaque smog, to the reactivation levels where sunlight could act on it.

Life-as-we-know it, with plants and animals in a balanced symbiosis, would not be possible. And the purely accidental radiation-activation of atmospheric components suggested would be immeasurably less efficient than the photosynthetic activities of plants. But still, a thin population of living things could evolve—a population as thin as, or thinner than, that in our ocean deeps.

And this could happen on what we must now recognize as the normal type of planet—the opaque-atmosphere planet.

But . . . could intelligent organisms evolve? Say on Jupiter. Thin as the population might be, with the stupendous size of the planet, there would still be possibilities of millions of entities.

The work on Project Ozma, seeking to contact possible other intelligent races on nearby other-star planets, assumed that any race as intelligent as the human race would, like us, develop and use radio-frequency communication.

We now have serious reason to question that.

On an opaque-atmosphere world, an intelligent race would never see sun, stars or planets; they would have neither weather nor climate.

Human science started with astrology—the science of predicting coming events—seasons—by the stars. It led to the necessity of measurement of angles. Quantitative-measurement is the basis of all our sciences—and they developed largely from astrology and surveying, which developed from the angle-measurement work and geometrical studies astrology induced. Astronomy offers no immediate pragmatic rewards such that a subsistance-level culture would support an observatory and an observer; astrology did. It was most decidedly important to learn how to predict the change of seasons. And then surveying became possible as a sort of unexpected bonus. And then . . .

The dark-world intelligences would not have that stimulus.

On Earth, the Eastern philosophers have tended far more toward the non-quantitative, purely-qualitative fields of subjective phenomena.

If, even on Earth, where there is powerful direct stimulus toward the quantitative measurement sciences, a major portion of the human philosophers have tended toward the qualitative-subjective—what would the dark-worlders do?

Radio techniques are an outgrowth of optics, actually—an extension of electromagnetic theory of light into lower frequencies was the original motivation of Hertz's experiments.

There's evidence that quite different types of possibilities exist, beyond the domain of science we know. Clairvoyants have existed; ESP does occur. Telekinesis has happened.

Suppose that there are planets of Tau Ceti, and Project Ozma's beamed radio signals are quite futile—just as futile as the Tau Cetans beamed clairvoyance-band transmissions. Never having worked with the electromagnetic spectrum, they don't have the radio-optical gadget we know as TV; they use an equally sophisticated gadget that is a clairvoyance machine. And they know that, obviously, any equally intelligent race anywhere must surely develop clairvoyance transmission equipment.

Would we recognize their civilization if we saw it? Or would they recognize ours if they encountered it?

They've been saying those "flying saucers" are purely illusions. Well—maybe they are. Purely subjective phenomena. Remote clairvoyance pickups, purely subjective devices, transmitted from Jupiter or Tau Ceti VI or. . . ?

But one thing seems rather starkly clear from the data we now have.

The Universe may be full of planets—millions and millions of them. Nice, normal planets . . . like Venus or Mercury or Jupiter.

But Man is going to have a problem. Terra-type planets are binary planets. It takes the contending gravitational fields of two condensing nuclei to strip the gases away from a major planetary body and leave a medium-large planet with a freakishly clear atmosphere.

And we're going to be pretty lonely in the Universe as a result.

Where is everybody?

Hidden under an impenetrable blanket of viciously corrosive smog . . . if they exist at all.

THE EDITOR.

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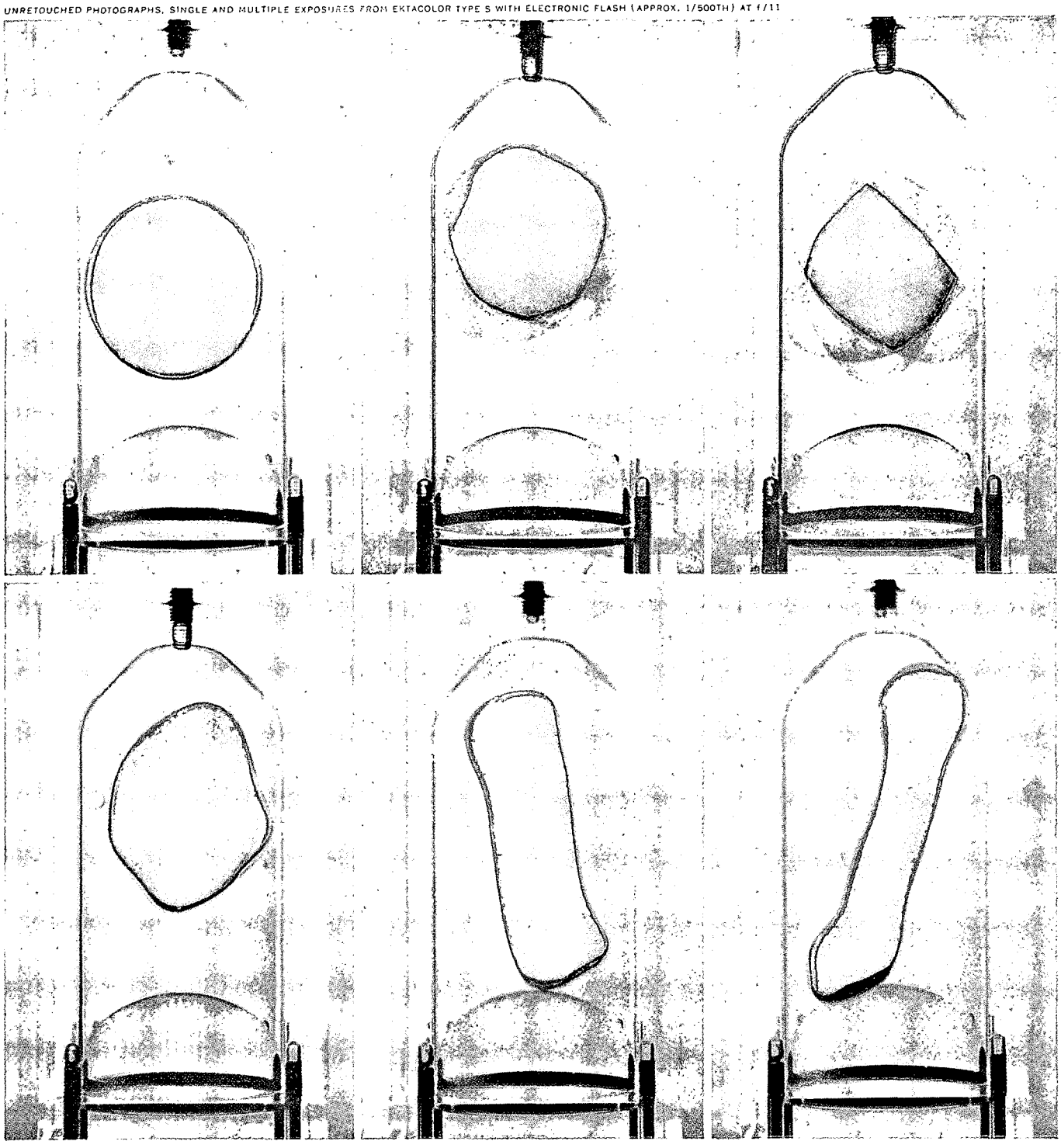

FOR EXTENDED STUDIES OF LIQUID BEHAVIOR IN ZERO-GRAVITY ENVIRONMENT...

Joint research by General Dynamics, National Aeronautics and Space Administration, and the U.S. Air Force has resulted in an insight of major importance. ∞ A lucite model of a space vehicle's fuel tank is used to simulate the effects of zero-gravity on propellants. The fluids filling the tank cavity—colored water, representing the *gaseous* hydrogen, and clear oil, representing *liquid* hydrogen—do not mix. Both are of equal density, and the natural surface of the water forms an interface of constant equal tension between them, which is almost like a membrane. Thus, the fluids behave as if they were in a zero-gravity state. They are shown above after various degrees of agitation and rotation. These tests duplicate fuel patterns seen earlier in models subjected to zero-gravity during elaborate drop tower and aircraft tests. ∞ This new "liquid-liquid" adaptation of an old principle is now permitting extended, low-cost study of one of the demanding problems of space flight . . . in the laboratories of General Dynamics.

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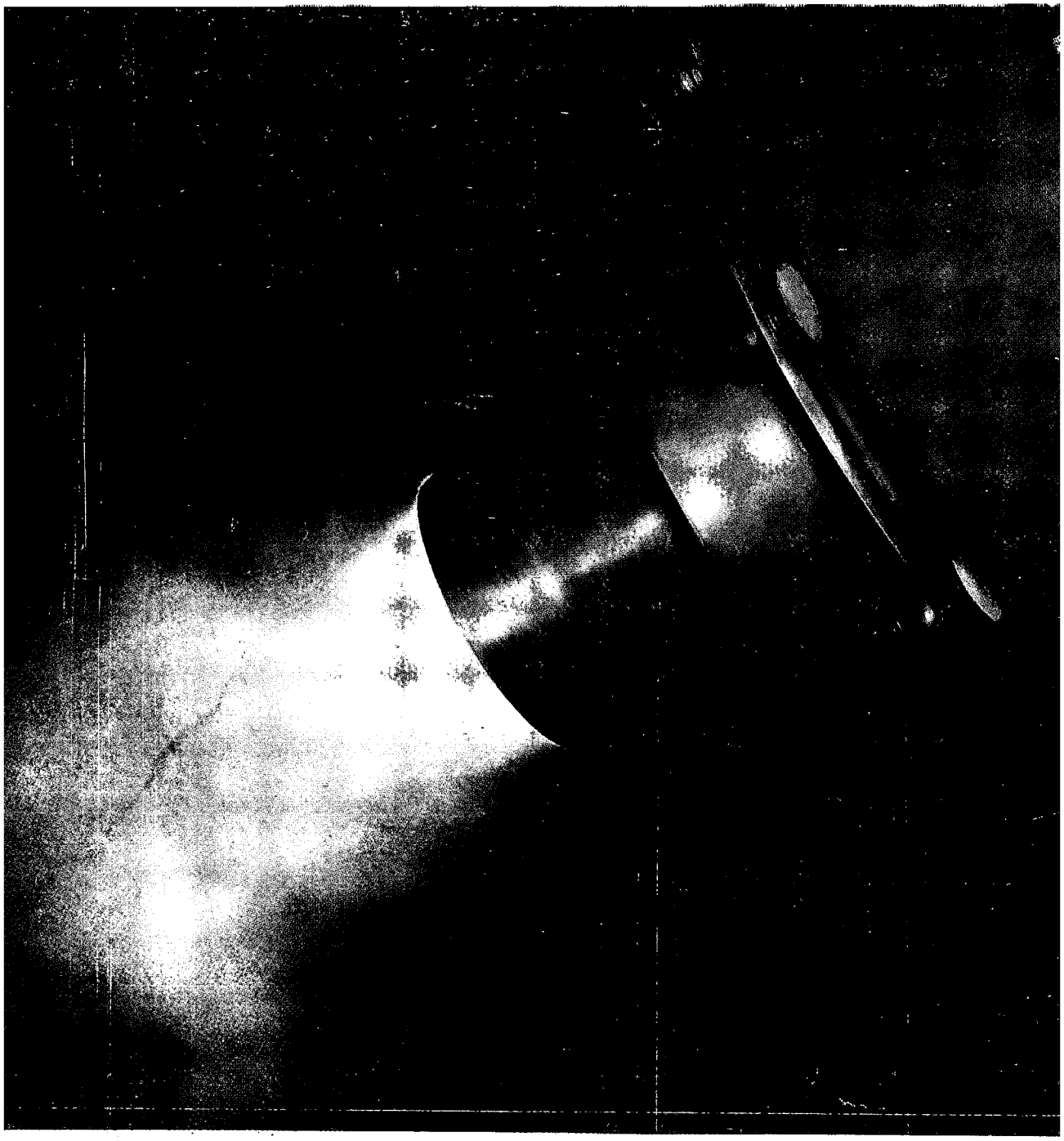

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